PUBLIC WORKS

April 1955

CITY, COUNTY AND STATE

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Roy R. Robinson, City Superintendent of Charlevoix, Michigan, has had broad experience in the municipal utility field. More on page 26.

how much does it cost...

...to have *Safest* CHLORINATION?

Nothing—when you buy a Fischer & Porter Chlorinator. That's true because fool-proof safety features are already engineered into this modern, instrument-type chlorinator.

> The F&P Chlorinator is instrument engineered from top to bottom to be absolutely safe in any emergency—and the safety features respond instantly. The mechanical design—without hydraulic devices to introduce time lag—make this a certainty...

In the F&P Chlorinator you can take a hammer and shatter the flowmeter tube—and the chlorinator shuts down *instantly*.

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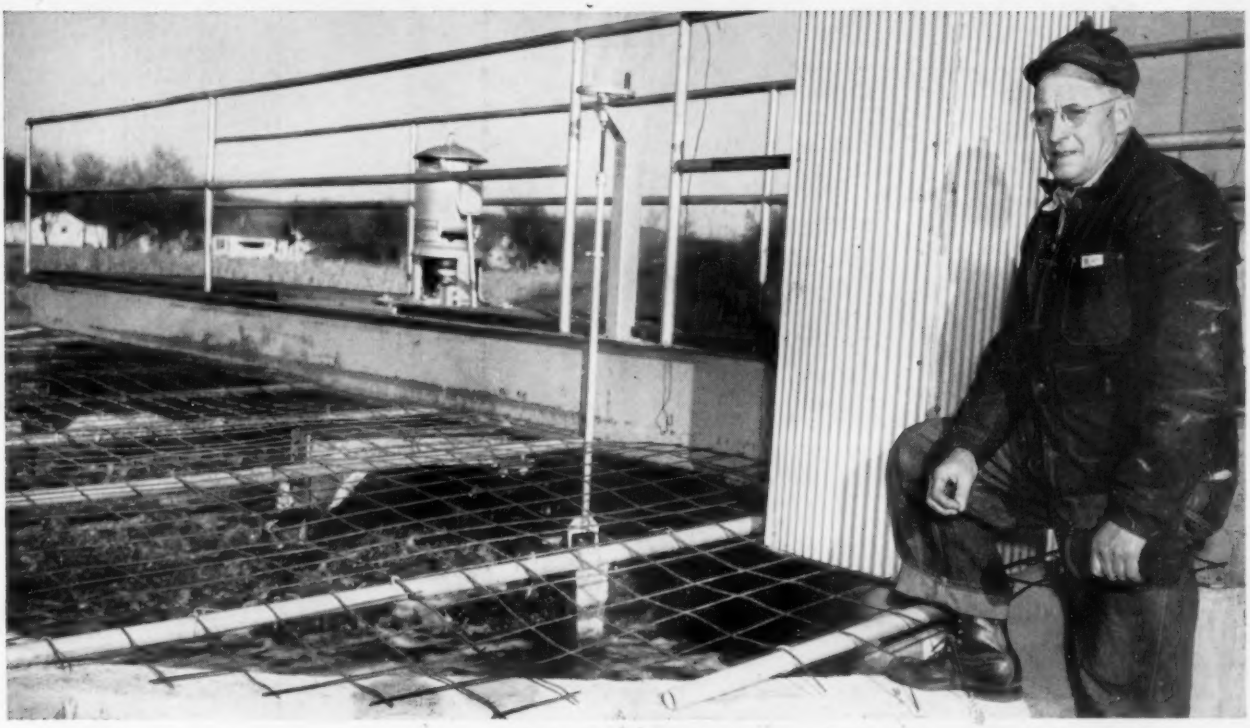

Mr. J. M. Bricker received the award at a retent meeting of the Nebraska Sewage and Industrial Wastes Association. Among other duties for the town of Paxton, Mr. Bricker spends about 12 hours per week looking after the 'Pakage' plant.

SCOTT-WILBUR

Award

"Sewage Plant Operator Having The Best Maintained And Operated Sewage Treatment Plant in Nebraska During 1954"

Award Winning Sewage Treatment Plant, Paxton, Nebraska. Installation contains one 14′ combination Aerator-Clarifier unit. Plant capacity: 75,000 G.P.D., treating domestic sewage. Consulting Engineer: Ogallala Engineering Company. Constructed by Beal Construction Company.

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Activated Sludge 'Pakage' Plant Performance Helps Win Coveted Award

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For small communities, industrial plants and institutions, specify Chicago 'Pakage' Plants. Write Dept. J for complete engineering data and drawings.

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—THE NO. 12 DOES A JOB

These two pictures, one taken in June, the other in February, show the same CAT* No. 12 Motor Grader at work for the City of Kellogg, Idaho. Whether there are streets to be graded or snow to be cleared, this big yellow grader does the job well.

"It's a wonderful machine," says Tom Olson, Street Superintendent. "And wonderful is the word for Caterpillar dealer service, too. Together they keep us sold on Caterpillar products."

This No. 12 is the second Cat Motor Grader owned by the city. The other—an old No. 10, purchased in 1937—is still running and doing its share of the work. That's not unusual, for 99% of all Caterpillar Motor Graders ever built are still in use! One reason is that genuine factory parts are available for all models. There are no "parts orphans" in the Caterpillar line.

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THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

THIS STRETCH of 9-foot wide Penetration Macadam shoulder will be given a Double Surface Treatment.

Bitumuls 3" Penetration Macadam for Heavy Duty Shoulders on West Virginia Turnpike

Bitumuls and a Specially-Built Compactor Team Up to Provide Maximum Stability

On a heavily traveled 30-mile section of the West Virginia Turnpike, safety and utility demanded the addition of a nine-foot shoulder. To provide a pavement-extension of maximum stability, Penetration Macadam with emulsified asphalt was specified.

Special Compactor

A special "articulated" compactor, designed for this particular job, was made up in two-foot sections to provide adequate flexibility for full-width compaction without rideover. This compactor gives maximum void filling, but Bitumuls easily penetrates down through the stone forming thin asphalt films that allow fractional contact of the graded stone thus assuring maximum stability.

Methods of Construction

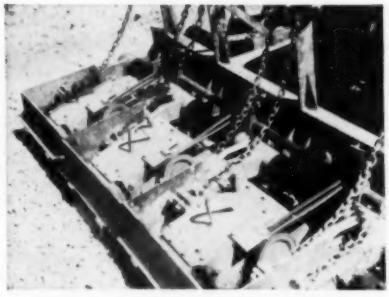
Base stone 2½" to 1" in size was placed at 210 lbs per sq. yd., rolled lightly, then choked with ½" to No. 8 chips, using the special compactor.

Bitumuls RS-1 was then applied at the rate of 0.25 gals/sq. yd., followed by a cover of ½" to No. 8 stone chips at 40 to 50 lbs per sq. yd. This cover aggregate was rolled with an 8-ton tandem, and a second application of Bitumuls RS-1 applied at 0.8 gals per sq. yd. Cover aggregate was again spread at 18 lbs per sq. yd.

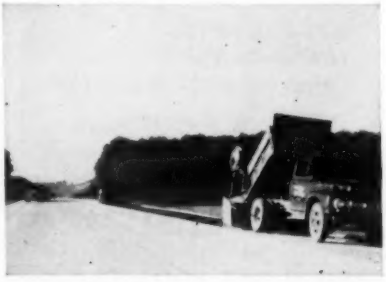
The surface was then given a Seal Coat of 0.5 gals per sq. yd. of Bitumuls RS-2 followed by imported limestone chips at 15 lbs per sq. yd. The final step in sealing the shoulders was a second Seal Coat of 0.25 gals per sq. yd. of Bitumuls RS-2, with the final cover of ⅜" to No. 10 chips at 10 lbs per sq. yd. This Seal Coat was then given a final rolling.

Bitumuls Field Engineers from our office nearest you will be happy to supply specifications on this or other types of paving.

Illustrated booklets on *all* types of Bitumuls construction and maintenance work are also available.



CLOSE-UP of the specially-designed "articulated" compactor showing the individual 2-foot sections.



SURFACING AND SEALING operations, Distributor applying Bitumuls (center) is followed closely by cover-aggregate truck. An 8-ton tandem was used to roll the cover aggregate.

AMERICAN Bitumuls & Asphalt COMPANY

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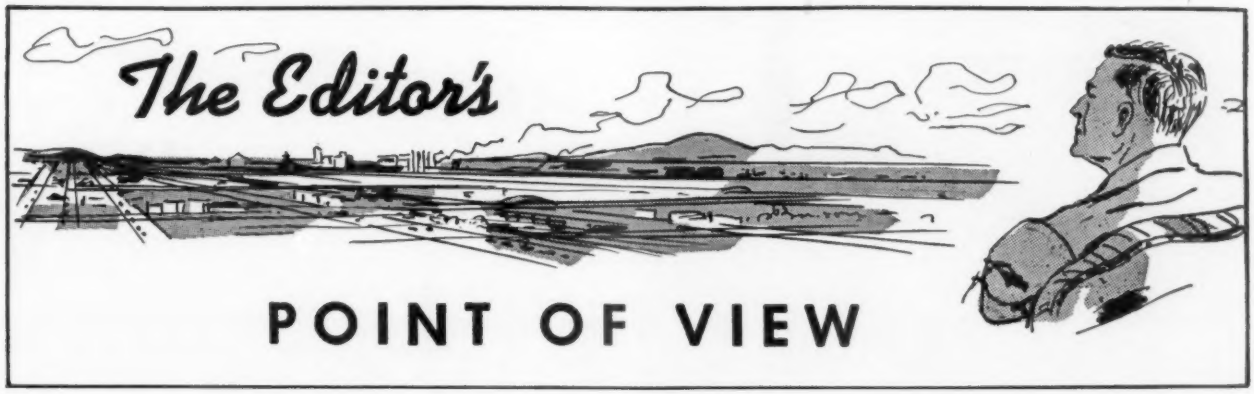

Getting More Sanitary Engineers For the Nation

THERE is some concern in collegiate circles over the slowness with which students are enrolling in sanitary engineering courses. The general feeling is that young men are unwilling to devote perhaps five years to sanitary engineering study, with no appreciable salary advantage over the 4-year civil engineer student when he graduates.

Granted that the well-trained sanitary engineer should first of all be basically qualified as a civil engineer, we don't agree that there is anything wrong with the young men. The attractions, rewards and satisfactions of being a sanitary engineer have never been explained to them; and it is asking a lot of the 18-year old to evaluate the intrinsic advantages of this field all by himself, and from a standing start, so to speak.

When sanitary engineering goes to the high schools with its story it will find many young men who will accept the challenge. There will always be a few with the philosophy "Pa's rich and Ma don't care", but there are innumerably more who will look beyond the immediate future and welcome the chance to serve, even if the cost and the effort are greater and the money returns modest.

Increasing Mechanization in Sewage Treatment Demands Higher Operating Skills

SINCE the days of the Imhoff tank, we have come a long ways in sewage treatment. Though the bulk of the cost of a plant may still be in concrete, an average plant serving even a smaller community is likely to have more than a hundred thousand dollars worth of highly technical and sensitive mechanical equipment in it. Often the sewage treatment plant represents one of the two or three largest investments made by the community. Despite all of this, some cities are still expecting untrained and underpaid personnel to return a profit on this investment.

It is past time that this condition was corrected. Operating personnel should be trained; they should be paid adequately and on the basis of being skilled in their profession; they should, at city expense, be members of the local and national sewage works associations; and they should attend short schools, meetings and conventions so that they may learn the latest developments in the field they serve. The forward-looking city will do these things and will reap a substantial profit from doing them.

The Engineer Should Have a Bigger Place in Our Future

OUR growing economy has produced many problems that must be solved soundly if our growth is to continue in the future. In all of these, the engineer must have a prominent place; in fact, one of the basic elements in our present day deficiencies is the past lack of early, comprehensive, courageous and long-range engineering planning. This applies alike to our overcrowded and dangerous highways; to the ominous threat of inadequate water supplies; to stream pollution; and to the many problems within these and related fields.

The engineer can do a great deal; he can work most effectively when he is not compelled first to clear away a lot of dead material from the past. Engineers are fine at curative problems, but the greatest payoff lies in their preventive ability.

Making Most Effective Use of the Public Works Facilities We Have Now

PLANNING, designing and building public works structures, whether for water, sewerage, highway or refuse facilities, take a long time—probably anywhere from two to five years, depending on size and other factors. In the meantime, we have to get along with what we have now, and the problem is how to do it most effectively and most economically.

To further such effective and economical use of present facilities, PUBLIC WORKS will publish, during the coming months, a number of how-to-do-it articles. The first one, appearing in this issue, has to do with details of and better methods for traffic control. We believe it will be helpful to many city and county engineers. More articles of the same general nature, but on other phases of work, will follow. We will try to make all of them available in reprint form.

Serves so well....

Installing 16" cast iron pipe for water line in Chicago, Ill.

Installing 12" Standardized Mechanical Joint pipe for Fall River Gas Works Co., Fall River, Mass.

Cast iron pipe installed for East Providence, R. I., Sewage Treatment Plant.

CAST IRON PIPE

It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

so many ways

A list of the many applications in which cast iron pipe serves so well might surprise you. Check them off. In *water* service—fire protection and supply lines, feeder and distribution mains, purification plants. In *gas* service, mechanical joint cast iron pipe is widely used for distribution mains. In *industrial* service, applications are almost endless in petroleum, process, chemical, paper and other industries.

Where effective resistance to corrosion and sustained carrying capacity are indispensable to long life and economy, specify cast iron pipe with confidence. For information write Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 So. Michigan Ave., Chicago 3, Ill.

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The Q-Check stencilled on pipe is the Registered Service Mark of the Cast Iron Pipe Research Association.

Standardized Mechanical Joint pipe water line installed in Mobile, Ala.

36" flanged Ell with special base for Chicago filtration plant.

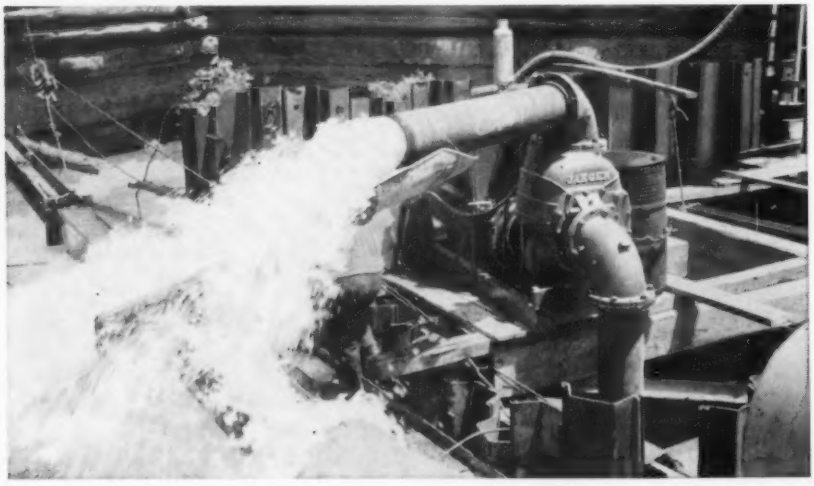
SERVES FOR CENTURIES...

Get full details of this month's products . . . mail your Readers' Service card today.

Hi-performance Jaeger pumps cut water-handling costs

New Model 2PN moves all the water a 2" hose can handle

This latest Jaeger 2" pump delivers its rated 10,000 gph when operating at only 2400 to 2550 rpm (as much as 400 rpm slower than similar pumps). It will actually pump all the water that can be pulled through a 2" suction line under average pumping conditions. You'll find it conservatively rated, even at heads well above 100 ft. Weighs only 190 lbs. including big pneumatic tires, measures only 24" x 21" x 26" high, yet it's built for heavy duty service with 20% steel shell, reversible liner plate, long-life Jaeger Lubri-Seal on shaft, impeller adjustable for wear and powerful Wisconsin AKN engine of 5.3 hp at 2500 rpm.

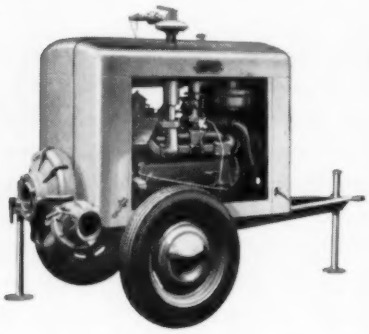


Pumping 4,000 gpm with low-cost diesel power

Because they develop their full rated volume at low operating speeds, big Jaeger pumps are ideally suited for diesel operation on big cofferdam and well point work. The Jaeger Model 10PD above is pumping 4000 gpm at 1500 rpm. This high efficiency at fuel-saving, engine-saving speeds is an exclusive characteristic of Jaeger "Sure-Prime" pumps. It requires larger shells and impellers but pays off in performance. Jaegers prime without engine-racing, don't vapor-lock on hard pulls, consume less fuel and average thousands of hours longer service than pumps that must run at higher speeds.

Latest type jetting pumps in 3", 4", 5", 6" sizes

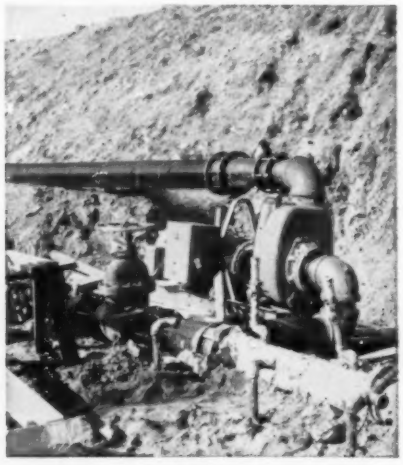
For a wide range of volumes, and pressures up to 275 psi, Jaeger has developed the most modern type of high pressure pumps . . . self-priming at the rate of 1 second per foot of lift, equipped with enclosed impellers, labyrinth sealing rings, positively lubricated shaft seals, automatic spring-actuated check valves, heat-resisting stellite-valved engines:



Model 3CPH delivers 420 gpm at 40 lbs., 125 gpm at 130 lbs., with air-cooled Wisconsin VF-4 (25 hp @ 2400 rpm).

Model 4CPH delivers 700 gpm at 75 lbs., 325 gpm at 200 lbs., with 6 cylinder engine of 218 cu. in. displacement (80 hp @ 2500 rpm).

Model 5CPH delivers 825 gpm at 80 lbs., 200 gpm at 250 lbs., with 6 cylinder engine of 236 cu. in. displacement. (95 hp @ 2600 rpm).



1½" to 10" Electric Pumps

Jaeger "Sure Prime" pumps with electric motor drive are available for all types of dewatering, including the operation of Jaeger Well Point Systems. The characteristic low speed (1150 rpm) operation of Jaeger 6" to 10" electric pumps results in much longer life. Jaeger's oversize shells, holding more priming water, also prevent overheating and vapor-lock even when exhausting the longest well point header lines.

For engineering service on pumping problems, or specific information about any Jaeger pumps, see your Jaeger distributor or write. For file data, request Catalog P-4.

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Installed Cost is Lower—Contractors everywhere have found that Transite's light weight, easy handling and fast, accurate Ring-Tite Coupling simplify assembly and save time. May be installed even under difficult weather and terrain conditions. The Ring-Tite design automatically locks tight, forming a positive seal.

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For further information about Transite Pressure Pipe and Ring-Tite Coupling, write to Johns-Manville, Box 60, New York 16, N. Y.

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WITH NEW RING-TITE COUPLING

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QUICK CLEANUP. Each day 45 tons of city garbage and much additional commercial waste is dumped at this river bottom site. But the TD-9 with Bullclam Shovel quickly gathers the refuse, places it in a trench which it had previously excavated, where it is compacted and covered at the close of each day.

Cedar Falls Finds Way to Banish Smog

Acrid Smudge disappears when Iowa city starts INTERNATIONAL DROTT Bullclam Shovel Method of Sanitary Fill

Each night along about bedtime the residents of Cedar Falls, Iowa, used to get wind of a sleep-stifling stench. It came floating up from the burning garbage dump in the river bottom, and sometimes the man-made smog didn't clear until noon.

But that's all just an unpleasant memory now, for Cedar Falls joined hundreds of other American municipalities—switching to the Bullclam Shovel Method of Sanitary Fill. And all it required was a modest investment in a TD-9 crawler tractor equipped with a matched Bullclam—a "One Man Sanitation Squad."

With this equipment, Cedar Falls city officials were able to snuff out the fire at the garbage dump, clean up the entire area, and handle the 45 tons of refuse daily in a safe and sanitary manner.

Operator George Baumgartner sums up the transformation this way:

"People living in the vicinity can sleep nights now. Taxpayers' complaints were changed to compliments, for we now have a dump that is free of flies, rats and odors."

If your city's refuse disposal costs are too high, call in your INTERNATIONAL Industrial Power Distributor. He'll show you how little it will cost to install the INTERNATIONAL DROTT Bullclam Shovel Method of Sanitary Fill . . . how much your community can benefit in health protection. He'll even provide expert assistance at no cost when you select the most advantageous disposal site. Call him soon.

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INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILLINOIS

INTERNATIONAL HARVESTER

INTERNATIONAL®
DROTT

Now's the time to mail this month's Readers' Service card.

SMALL INVESTMENT, BIG RETURNS. The 41 drawbar horsepower TD-9 diesel crawler with Bullclam Shovel is paying big returns for Cedar Falls. At first the unit had to clean up the old messy garbage dump in addition to burying refuse. Now the disposal job is handled in a few hours each day and there is no mess—as is apparent in this photograph.

NEW FROM INTERNATIONAL DROTT!

Amazing 4-in-1 Skid-Shovel Converts Into a

- **BULLDOZER**
- **BULLCLAM**
- **SKID-SHOVEL**
- **CLAMSHELL**

By Shifting Hydraulic Selector Lever

City officials everywhere are talking about the amazing new 4-in-1 Skid-Shovel, the latest addition to the long line of INTERNATIONAL DROTT products.

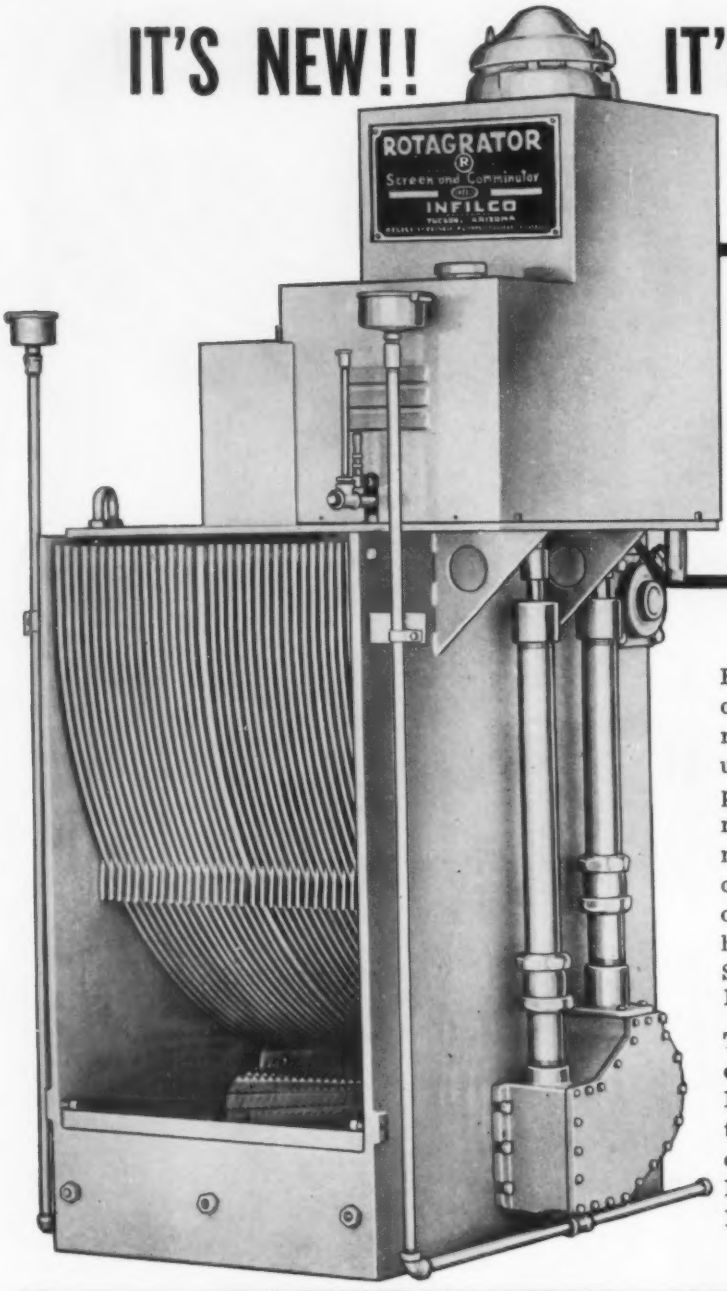
Available on INTERNATIONAL TD-6 and TD-9 crawlers, the new 4-in-1 is the most productive and versatile tool ever. Use it as a Bullclam for a Sanitary Fill project—and then for the hundred-and-one odd jobs around town. The 4-in-1 can immediately be converted to a Bulldozer, Skid-Shovel or Clamshell . . . and by just shifting the "shovel selector" lever into desired position.

See it work and you'll see the equipment savings your municipality can make. Your INTERNATIONAL Industrial Power Distributor will arrange your demonstration whenever, wherever you say. Call today so you'll have all the facts on this equipment that is big in performance, small in price.

CITY OF ROCKWOOD, TENNESSEE, uses new INTERNATIONAL DROTT 4-in-1 Skid-Shovel on sanitary fill and scores of other loading, dozing and materials handling jobs... finds its productivity matches bigger sized crawler and loader.

It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

IT'S NEW!! IT'S REVOLUTIONARY!!



ROTAGRATOR®
screen and comminutor

Here is a unit that really screens and comminutes coarse sewage material without removal or rejection from the flow. Solids are held upstream until they are reduced to a size that permits passage downstream. Unpleasant and expensive manual removal methods, odors and other nuisances are eliminated when the "ROTAGRATOR" comminutor is installed. This equipment operates at a low head loss, and efficiently handles a wide variety of solids.
Straight line installation reduces initial costs.
Low power requirements reduce operating costs.

The "ROTAGRATOR" screen and comminutor was developed for larger communities to complete INFILCO'S extensive line of sewage and waste treatment equipment. For more information on the "ROTAGRATOR" comminutor and other INFILCO equipment, see your Consulting Engineer and write for literature.

Typical materials that have been successfully comminuted in the "ROTAGRATOR" comminutor include:

rags
cans
rubber products
glass
rope
wood

INFILCO

The one company offering engineered equipment for all types of water and waste processing—coagulation, precipitation, sedimentation, flotation, filtration, ion exchange and biological treatment.

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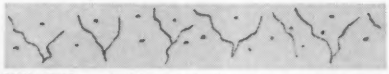
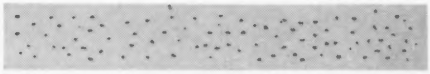
3 BASIC REASONS WHY
STERLING ROCK SALT STABILIZED ROADS
Wear Better, Longer . . . with Less Maintenance!

1. Greater Compaction Means Greater Density!

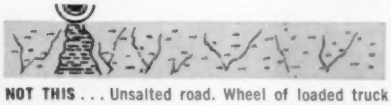


NOT THIS . . . Without salt, ingredients of the mix remain "loose." Clay binder cannot repel moisture. Excess rain makes rivulets. Dried out, they leave weakening crevices.



BUT THIS . . . With salt, you get better compaction. Brine film is thinner than water, allowing tighter bond of the whole mix. Clay, with brine, repels excess rain at surface. No rivulets. No weakening crevices.

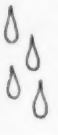
2. Greater Load Transference Means Longer Road Life!



NOT THIS . . . Unsalted road. Wheel of loaded truck puts a great weight on one point of surface. Roadbed supports load **vertically** . . . by only the structure directly beneath it.

BUT THIS . . . Salted road. Because of greater compaction, same load is diffused **horizontally.** Strain is spread outward and downward to about 40 inches at base to each surface inch.

3. All-Weather Resistance Means Lower Maintenance Costs!



EXCESS MOISTURE. Binding materials are not washed out. Clay, with brine, forms colloidal jelly. Repels excess rain, keeps it from weakening structural strength of mix.

EXCESS DRYNESS. Salt recrystallizes. Fills voids. Holds clay binder. Forms protective shield which retains some moisture in mix, resisting suction-like action of traffic.

FREEZING. Salt lowers freezing point. Frost does not penetrate. Prevention of below-surface freezing helps eliminate spring "heave" and pot-holing.

"Nature's own Soil Stabilizer"

For Base . . . Surface . . . and Shoulder Stabilization . . .

STERLING ROCK SALT

INDUSTRIAL DIVISION
INTERNATIONAL SALT COMPANY, INC., SCRANTON, PA.

FREE PAMPHLETS! Up-to-the-minute methods of highway construction and maintenance.

International Salt Co., Inc., Industrial Division, Scranton 2, Pa.

☐ Please send Road Stabilization literature.
☐ Please have representative call.

Name_____

Company_____

Street_____

City_____ Zone___ State_____

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TWO BLAW-KNOX BASE PAVERS SPREAD 800 TONS PER HOUR ON MARYLAND RELOCATION JOB

These two Model P-150 Base Pavers each spread 400 tons of No. 4 stone per hour on Maryland Route 40. On this 14 mile stretch they spread 12-ft. strips to a depth of 13 inches.

Paving base course to specifications on any highway or airport job is fast, accurate and economical with the big-capacity Model P-150. It lays large stone, slag, gravel, soil cement or crusher run aggregate evenly, *without segregation,* in widths up to 16 feet and depths to 20 inches. Oscillating V-type screed assures "straightedge" leveling. Large low hopper permits practically any truck to back up and dump easily. Wide tracks provide plenty of traction for soft going and there's ample power to push your trucks.

High-speed performance and low-cost operation of Blaw-Knox Base Pavers can help you put your job in the high profit class. Your Blaw-Knox distributor will gladly explain every feature.

BLAW-KNOX

BLAW-KNOX COMPANY
CONSTRUCTION EQUIPMENT DIVISION
Pittsburgh 38, Pa.
Offices in Principal Cities

BLAW-KNOX ROAD WIDENERS SPREAD CONCRETE WITHOUT FORMS ASPHALTIC CONCRETE OR AGGREGATE

Profitable widening jobs are the result of speedy, efficient operation that builds earth shoulders at a 200 ton per hour pace . . . spreads and finishes concrete up to 1½ miles per day. Big savings on widening costs, because forms are not required for laying concrete. On a 10-mile strip, 6 feet wide, a Blaw-Knox Widener saved almost $20,000! Two models available to handle widths from 2 to 10 ft

BLAW-KNOX also manufactures a "Complete Package" of concrete paving equipment

Clamshell Buckets

Batching Plants

MultiFoote Pavers | Spreaders and Finishers | Road Forms

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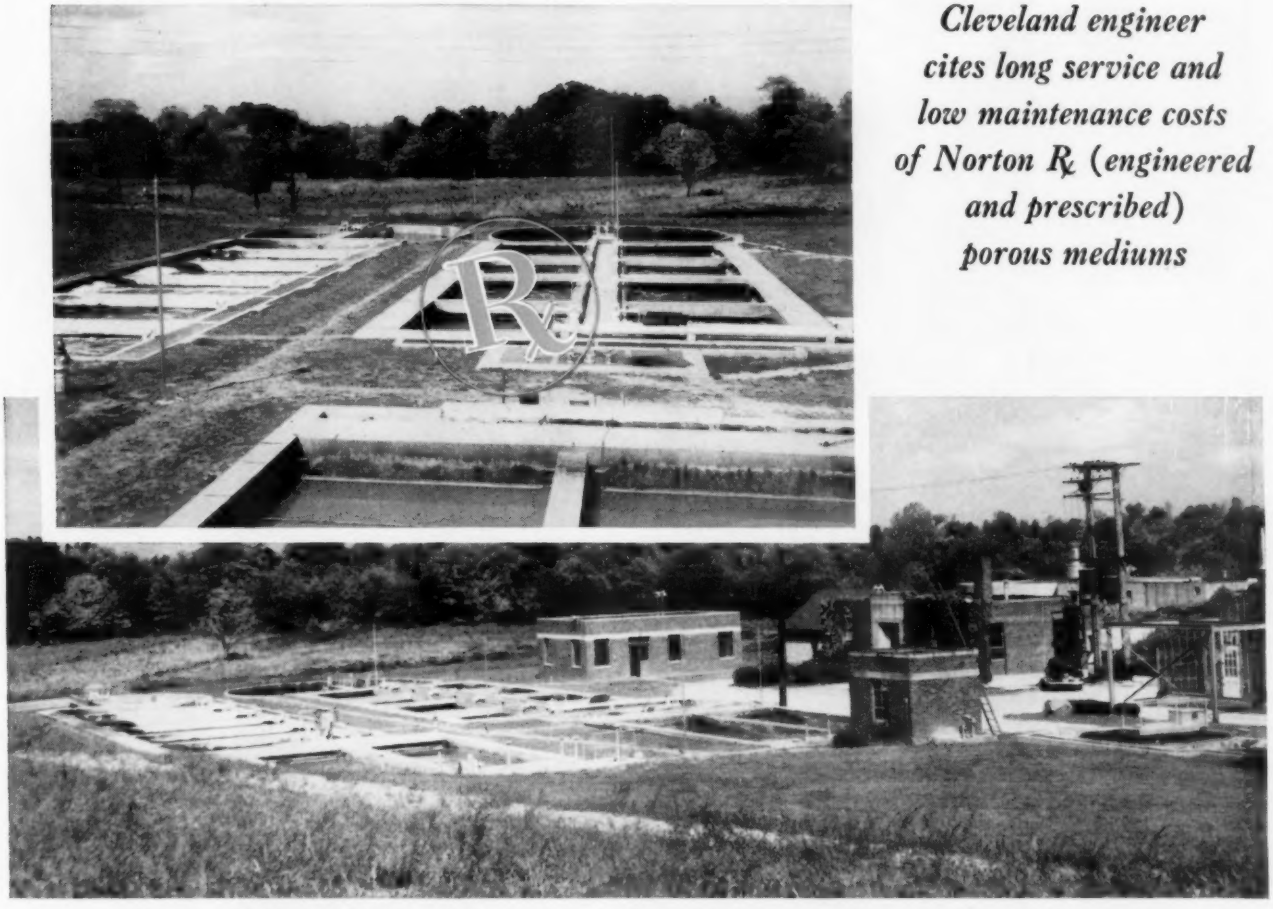
"We think highly of Norton plates"

Cleveland engineer cites long service and low maintenance costs of Norton Rx (engineered and prescribed) porous mediums



Plates In This Berea, Ohio, Sewage Plant are from the famous Norton line of Rx porous mediums, engineered and prescribed for many important uses. Smaller photo shows close-up of tanks.

"We think highly of Norton plates. In fact, your plates at Berea, Ohio, installed in 1937 are still intact and were cleaned for the first time in 1951."

This message from Rollin F. MacDowell of Rollin MacDowell & Associates, Consulting Engineers of Cleveland, describes a specific installation where Norton Rx porous mediums insure top performance and keep maintenance costs down.

All Norton ALUNDUM* porous mediums are made with the patented *controlled structure* process that assures even distribution of pores — for uniform diffusion — in the size and open-pore ratio that best meets your needs. And Norton tubes have the seamless construction that provides unobstructed diffusion over their entire area and enables faster, more thorough cleaning.

Other Big Advantages

of Norton Rx porous mediums include exceptional resistance to breakage and chipping and their ability to stand up under cleaning with acid. They're made in a wide range of sizes . . . tubes and discs for aeration in activated sludge treatment . . . tubes for diatomite filters in swimming pools . . . plates for rapid sand filters in water filtration.

Get The Whole Story

Norton illustrated booklets bring you helpful charts, tables and important information on your own use of porous mediums. Ask your Norton Representative, or write direct to NORTON COMPANY, 223 New Bond St., Worcester 6, Mass.

NORTON

POROUS MEDIUMS

Engineered . . . Rx . . . Prescribed

Making better products . . . to make other products better

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

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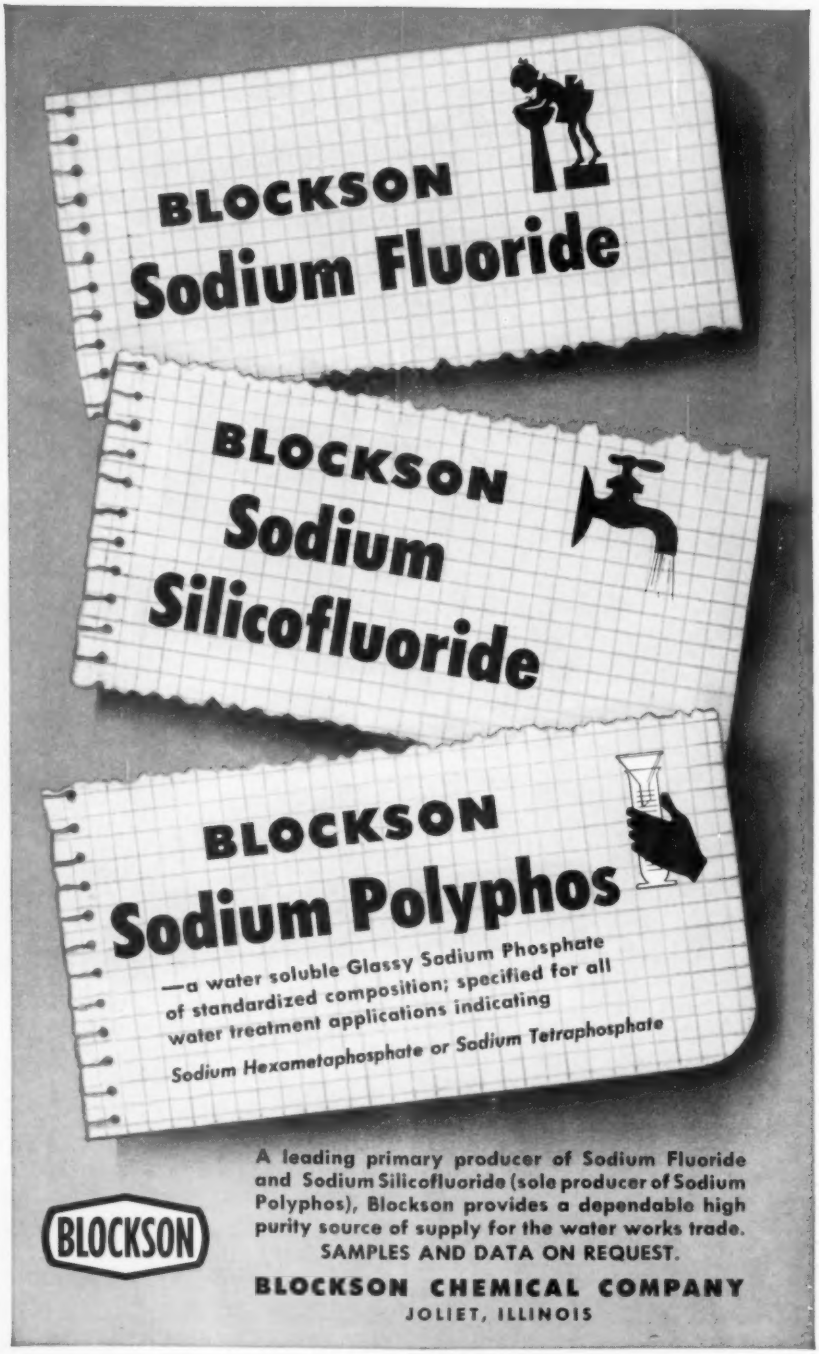
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A leading primary producer of Sodium Fluoride and Sodium Silicofluoride (sole producer of Sodium Polyphos), Blockson provides a dependable high purity source of supply for the water works trade.
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BLOCKSON CHEMICAL COMPANY
JOLIET, ILLINOIS

Rigid Radius
Curb and Gutter Forms

Here's Why HELTZEL Forms Outperform All Others

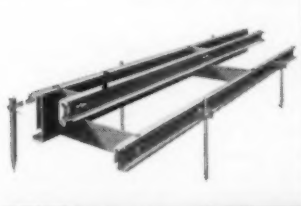
It takes more than a bending press and a welding torch to build practical, serviceable concrete forms. You've got to know concrete pouring and design for fast form set-up and quick stripping. You've got to know steel to design a form that can take punishment without being heavy and bulky. You've got to have wide experience in the construction field to design a versatile form that can cover a variety of installations.

The form must have strength, be easy to use, hold alignment under the most difficult conditions and deliver maximum wear.

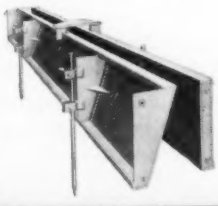
These are a few of the reasons why formsetters and contractors alike **prefer Heltzel Forms.** Heltzel has almost 50 years experience in designing and building metal forms for construction use. Many of the features of the modern day form were developed by Heltzel engineers. And why not? They're the most experienced designers and builders of forms in business today.

That's why **Heltzel Forms** consistently outperform all others. That's why it's just smart business to make certain, when purchasing form equipment, you check first with the Heltzel representative nearest you. If you're not familiar with him write direct and we'll send his name and address by return mail together with the latest literature on Steel Forms.

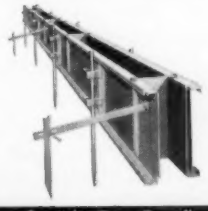
A Few Examples of HELTZEL Curb and Curb and Gutter PerFORMers..



Interchangeable Face Curb and Gutter Forms

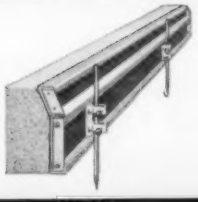


Battered Face Dowell Joint Curb Forms

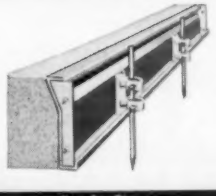


Straight Face Dowell Joint Curb Forms

Rigid Radius Curb Forms

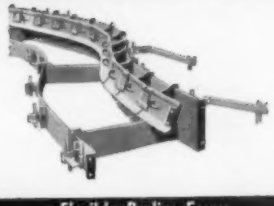


Two-Piece Front Curb Forms



Single Piece Front Curb Forms

Flexible Radius Curb and Gutter Forms



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12000 THOMAS ROAD, WARREN, OHIO

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designed by a champion for championship performance for a lifetime

American Approved

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lifetime

aluminum diving board

world's finest official regulation board

SAFE Its aircraft design eliminates the torque (twisting action) at the tip of the board, giving an added safety factor not found in any other type diving board. The non-skid Safety Tread is full 18″ wide.

OFFICIAL Meets all requirements for A.A.U., N.C.A.A., F.I.N.A. Championships.

DURABLE It will give years of dependable service under constant use. Built to withstand the everyday rugged use which the commercial pool patrons will give it, yet will provide maximum springing qualities.

BEAUTIFUL The graceful lines and glistening aluminum color of the Lifetime board will enhance the beauty of your pool.

ECONOMICAL Eliminates the broken diving board problem, increases patronage. Will pay for itself within just a few seasons.

LIGHT WEIGHT Weighs less than conventional wood or coated-wood diving board, is easier to install or remove for storage.

SCIENTIFICALLY DESIGNED Designed to withstand many times the actual load requirements. Its spring-leaf design gives added strength in the fulcrum area where it is most needed, and lightness at the tip.

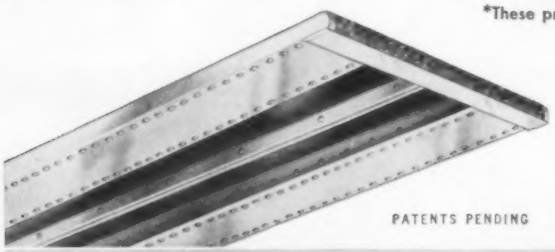
Only American Approved Jim Patterson LIFETIME Aluminum Diving Boards Offer You These Highly Important Plus-Features

Exhaustive tests at scores of installations prove that only the new American Approved Jim Patterson LIFETIME Aluminum Diving Board will withstand extremely severe use, day after day, yet continue to deliver unmatched performance, year after year, free from repair or replacement cost. Only the Jim Patterson Lifetime Aluminum Board fits any regulation diving standard, is so easily installed or operates so noiselessly. Effortless take-offs, uniform flexibility throughout the entire board, with no torque, twisting action or distortion at the tip. Protected fully against salt water or corrosion. American's Battleship Safety-Tread, full 18″ wide, provides the safest, most attractive and most comfortable non-slip covering known. Unequaled in design or construction by any other aluminum or fiberglas-coated wood board, here is the world's finest Official Regulation Board!

No. APL-14 LIFETIME Aluminum Board, 14′ long, with Battleship Safety-Tread. Weight, 130 lbs. $325.00

No. APL-16 LIFETIME Aluminum Board, 16′ long, with Battleship Safety-Tread. Weight, 140 lbs. $325.00

*These prices are f. o. b. our factories at Anderson, Indiana or Columbus, Ohio



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BRUCE HARLAN, 1948 Olympic Diving Champion

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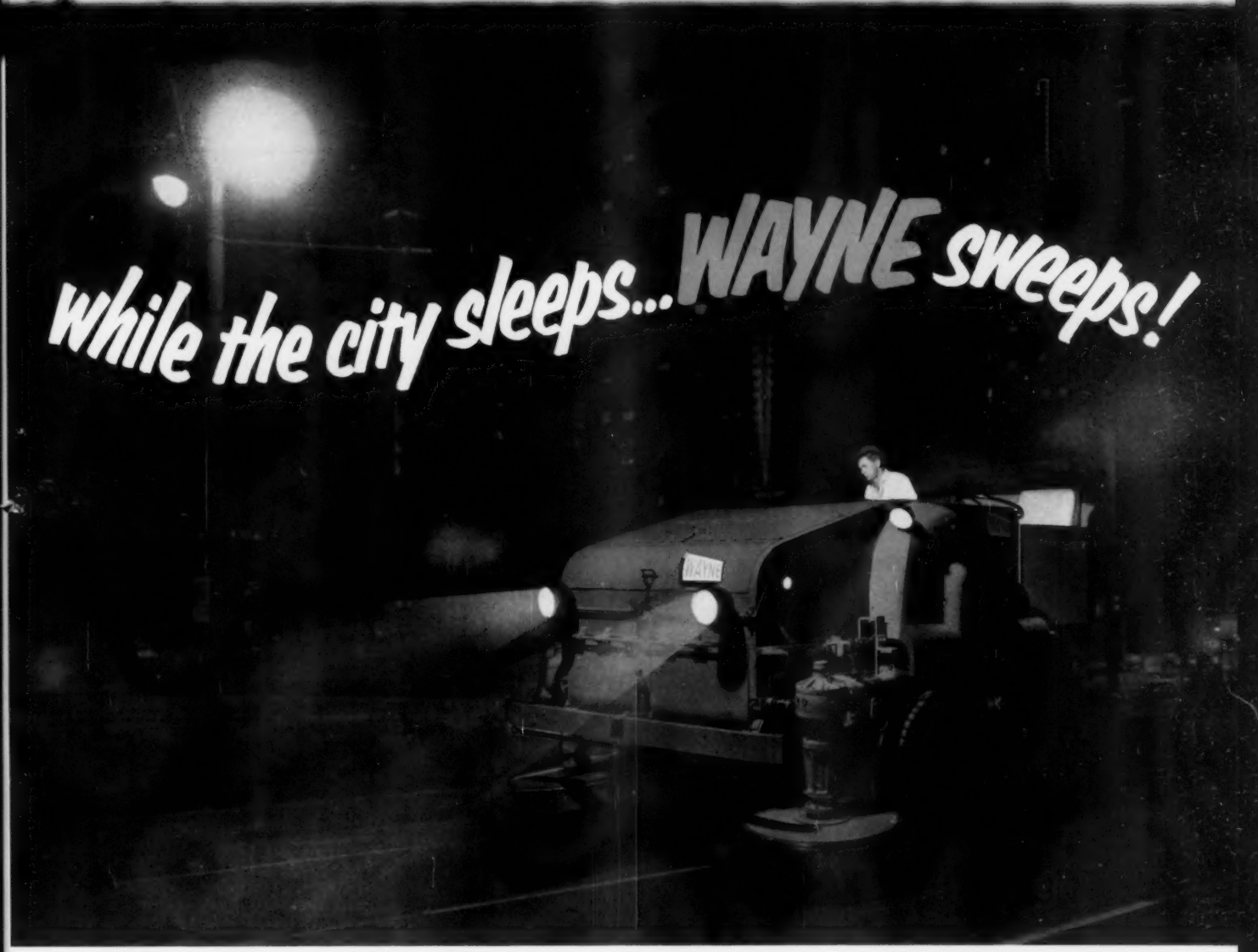

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Night and day, around the clock on the streets of leading cities throughout America, Wayne Street Sweepers are proving their dependability, ruggedness and superior performance.

That's because every Wayne feature has been test-proved under the severest conditions of climate, terrain and daily use year after year.

Wayne pioneered and perfected the efficient features that today are the standard of the industry. That's why . . . when you purchase a Wayne Sweeper, you invest in the most dependable, economical, advanced street sweeper ever built.

Regardless of area, terrain or population, Wayne does the best sweeping job at lower cost. And that is a matter of record!

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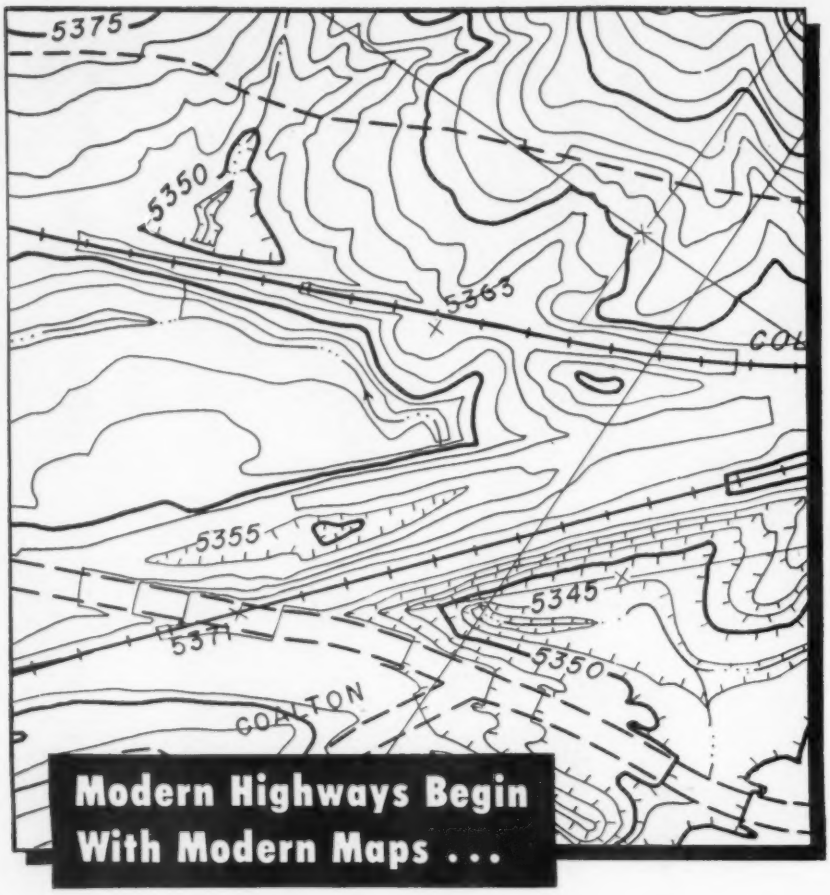

Modern Highways Begin With Modern Maps . . .

Post-war automobile production has put more vehicles on our highways than they were ever designed to handle. More and new types of highways are vitally needed now. Freeways, turnpikes and toll roads are being planned to shorten the distances, reduce grades and reduce travel time.

Topographic maps produced by Jack Ammann photogrammetric methods— have been produced— or are now being produced for the following:

- **Denver-Boulder Turnpike**
- **West Virginia Turnpike**
- **Kansas Turnpike**
- **Dallas-San Antonio Turnpike**
- **Dallas-Ft. Worth Turnpike**
- **Highway Departments of Vermont, Massachusetts, New York, Connecticut, Rhode Island, New Jersey, Kansas, Texas, California, Washington and Oregon.**

To meet this immediate need, highway officials and consulting engineers have turned to the services of Jack Ammann Photogrammetric Engineers. With Jack Ammann photogrammetry work can be speeded — costs can be cut—just as the highway projects listed have found.

Consult us on your mapping needs. Put our nearly a quarter-of-a-century of mapping experience to work.

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AIR SURVEYS—MAPS
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OFFICES AT: 32 Hillcrest, P.O. Box 411, Manhasset, N.Y.; 685 W. Peachtree St., N.E., Atlanta, Ga.; 1354 Chantilly, Houston, Texas; 995 Flower St., Lakewood (Denver), Colo.; 53 E. Fedora Ave., Fresno, Calif.

Now's the time to mail this month's Readers' Service card.

NAVY SANITARY ENGINEERING

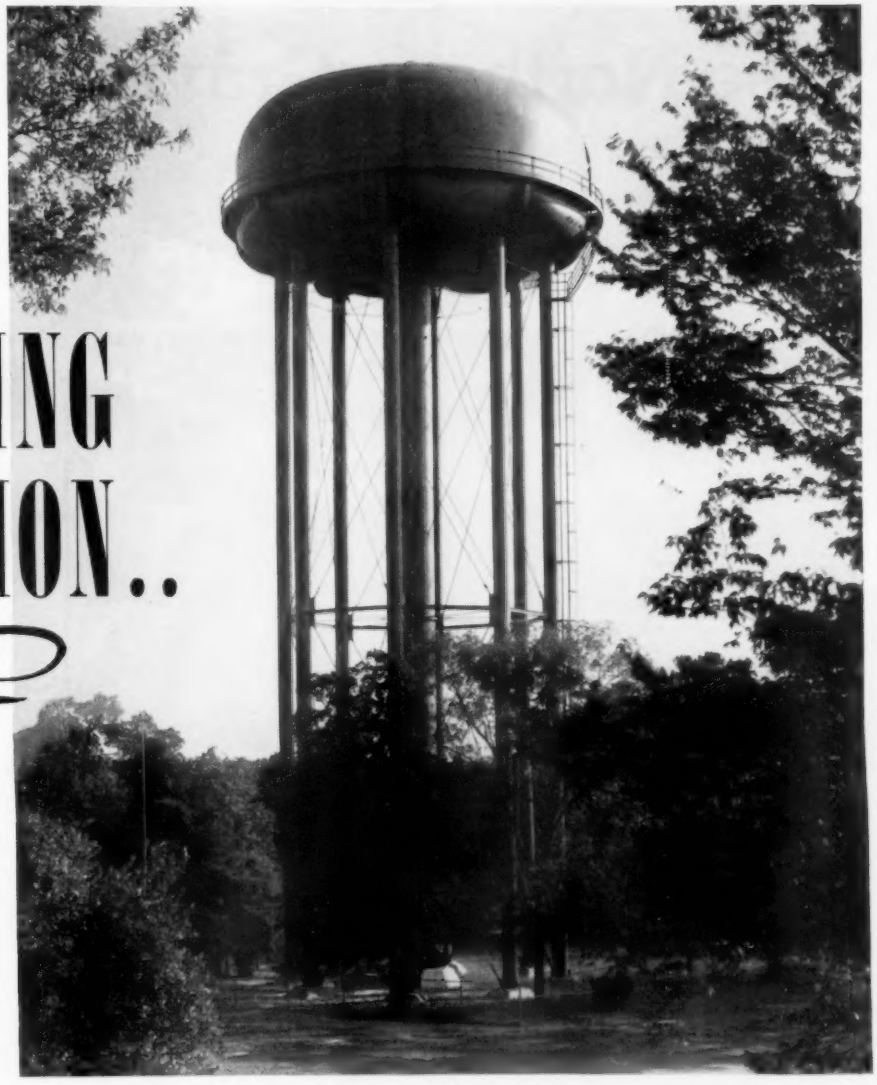
I have just concluded reading page 7 of "The Editor's Point of View" in the February issue of the Public Works Magazine. The subject matter concerns the commissioning of 1,000 engineer reserve officers by the Public Health Service. The writer subscribes wholeheartedly to the aims and objectives of the Public Health Service in its recruitment program. However, I considered it extremely regrettable that you saw fit to malign the engineering services of the defense agencies and, in particular, the Navy. in an effort to add impetus to this program. It appears to me that you gained no useful purpose by your references to the military in this matter. I take strong exception to your statement "The Navy never has had any idea of what sanitary engineering can do".

The Navy's Civil Engineer Corps' renowned professional attainments need no recounting here. This Corps is composed of graduate engineers, many of whom majored in sanitary engineering. Further, many civilian sanitary engineers are employed on the staff of Civil Engineer Corps officers. Their duties require close coordination with the Medical Department relative to the health and sanitary engineering requirements at military installations.

Furthermore, a large percentage of the Civil Engineer Corps officers have undergone training relative to the health problems associated with atomic, biological and chemical warfare. Also, the Civil Engineer Corps sends many of its officer personnel to post-graduate study in sanitary engineering at well-known and reputable universities in this country. It appears to me that the mission of the Public Health Service is to carry out assigned responsibilities in the field of public health for the civilian population of the country during a period of national emergency. The mission of military engineers is to carry out these same

World's leading producer of power sweepers for cities and industry

A GROWING TRADITION..



...HORTON Elevated Water Tanks

The 500,000-gal. Horton® radial-cone bottom elevated tank shown above is an example of the growing ranks of Horton elevated tanks that are serving small communities, villages and cities throughout the nation. Installed at Aiken, S. C., it provides their municipal water system with a reserve of water, ready to flow twenty-four hours a day by dependable gravity pressure, to meet peak load periods and emergencies.

Horton elevated tanks are built in capacities to 3,000,000 gallons. Write the nearest CB&I office for further information, estimates or quotations.

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Use Northern Gravel for Rapid Sand Filter

The South District Filtration Plant of the city of Chicago, is the largest in the world. Northern Gravel Company furnished them 422 carloads with clocklike regularity, enabling installation continuously and economically

Filter Sand Specifications

are carefully laid out. The Effective Sizes and Uniformity Coefficients used by Consulting Engineers and also recommended by the American Water Works Association are the result of long years of research and experience.

The Northern Gravel Company is equipped to give you prompt shipment whether it be one bag or many carloads, exact to specifications. Filter sand can be furnished with any effective size between 0.35 MM and 1.20 MM.

Chemical Quality

of the filter sand is also important. It must be hard, not smooth, and free of soluble particles. This requires perfect washing and grading facilities. We have every modern device for washing, drying, screening and testing.

Filter Gravel

supporting the Filter Sand Bed, must be in turn, properly graded to sizes calculated to support the Filter Sand, and be relatively hard, round and resistant to solution.

Northern Gravel has no equal in facilities and our reserves of both sand and gravel are inexhaustible. Northern Gravel Company has been in business over 40 years. We guarantee uniformity of products and our records enable us to duplicate your requirements on short notice. Our location is central and we have commodity rates in every direction.

Northern Gravel Company
Muscatine, Iowa

Box 307 Ph.: Amherst 3-2711

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responsibilities for the military forces wherever they may be. Obviously, their training is not exactly similar inasmuch as the conditions to be met on overseas bases are not exactly analogous to stateside conditions.

For the reasons outlined above, the writer considers that the Editor's comments relative to the engineering ability of defense agencies do not lend impetus to the Public Health Service program. It is further hoped that the Editor sees fit to retract his statements in a future editorial of Public Works Magazine.

J. R. Burke
Commander, CEC, USN
Public Works Officer

Editor's Reply: In the February editorial to which Commander Burke and others have taken exception, I had specific reference to overseas operations. There is no question regarding the skills and abilities of the sanitary engineers in the Navy Civil Engineer Corps. There is, however, a serious question whether an organization now exists which has the skills and the abilities to protect military personnel in operations in tropical areas, as in the Southwest Pacific during World War II. There is no reason to believe that, if another war comes, it will be fought in areas where malaria, scrub typhus and other similar diseases are no problem. We must, therefore, be prepared to provide the engineering and scientific skills necessary to protect our troops in such areas. To the best of my knowledge, no organization exists today which can be relied on to carry out this mission.

The pride of service which prompted these several letters is appreciated and applauded. It is hoped that from this, steps may be taken toward the development of an adequate public health and sanitary engineering service in the armed services.

• • •

EUROPEAN CHAPTER ORDER OF THE BOAR

You are most cordially invited to attend the Third Annual Dinner of The European Chapter, ORDER OF THE BOAR, at the USAREUR Medical Training Center, Landstuhl Army Medical Center, Landstuhl, Germany, on 23 April 1955 at 6:30 P.M.

J. I. Martin
Major General, MC

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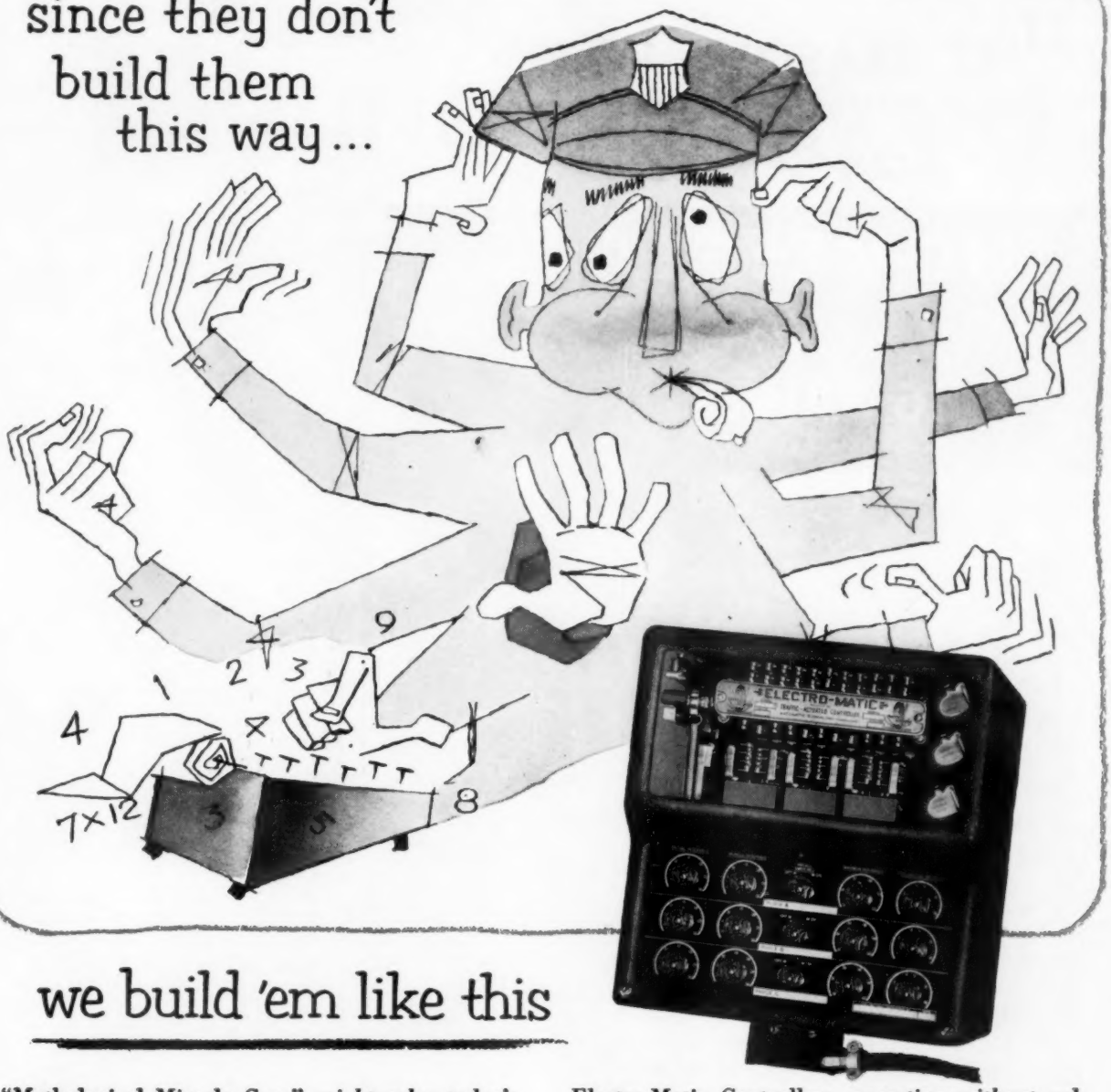
since they don't build them this way...



we build 'em like this

"Mythological Miracle Cops" *might solve* today's problems of congested intersections, but Electro-Matic Controllers *can most surely solve* them both for today and tomorrow.

Traffic engineers and police officers the country over rely on "Electronic Brains" to expedite traffic flow more efficiently than by *any other method.*

Electro-Matic Controllers, operating *without* volumetric limitations, continually adjust to the ever changing patterns of traffic volume thereby clearing intersections faster.

Policemen, previously pressed into traffic duty, can now be utilized to better advantage. Thus, the aims of efficiency and economy are *both* realized.

Electro-Matic Controllers are designed to cope with *your* most difficult intersections. *For details, write for further information.*

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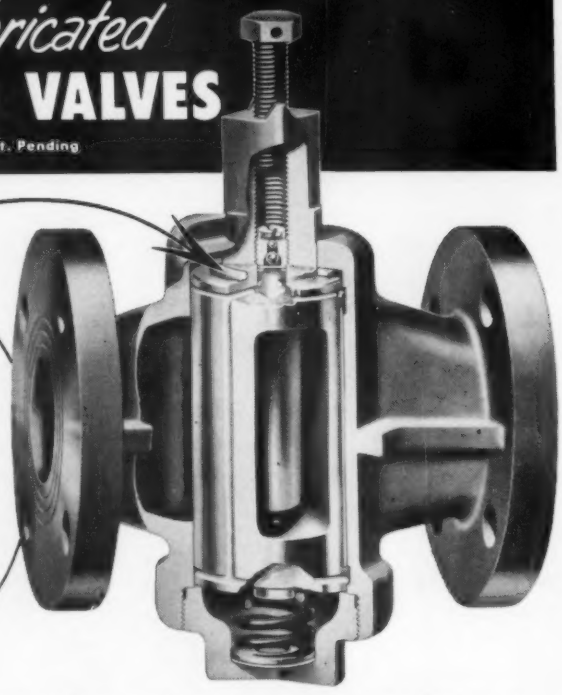

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. . . which will not cold-flow, and which provides a positive seal against leakage—even under 200 pounds pressure per square inch, *without lubrication*.

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1. Reinforced Teflon packing ring.
2. Completely controlled high-pressure lubricant system.
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8. Triple head-seal with Lubricant and Teflon packing ring.
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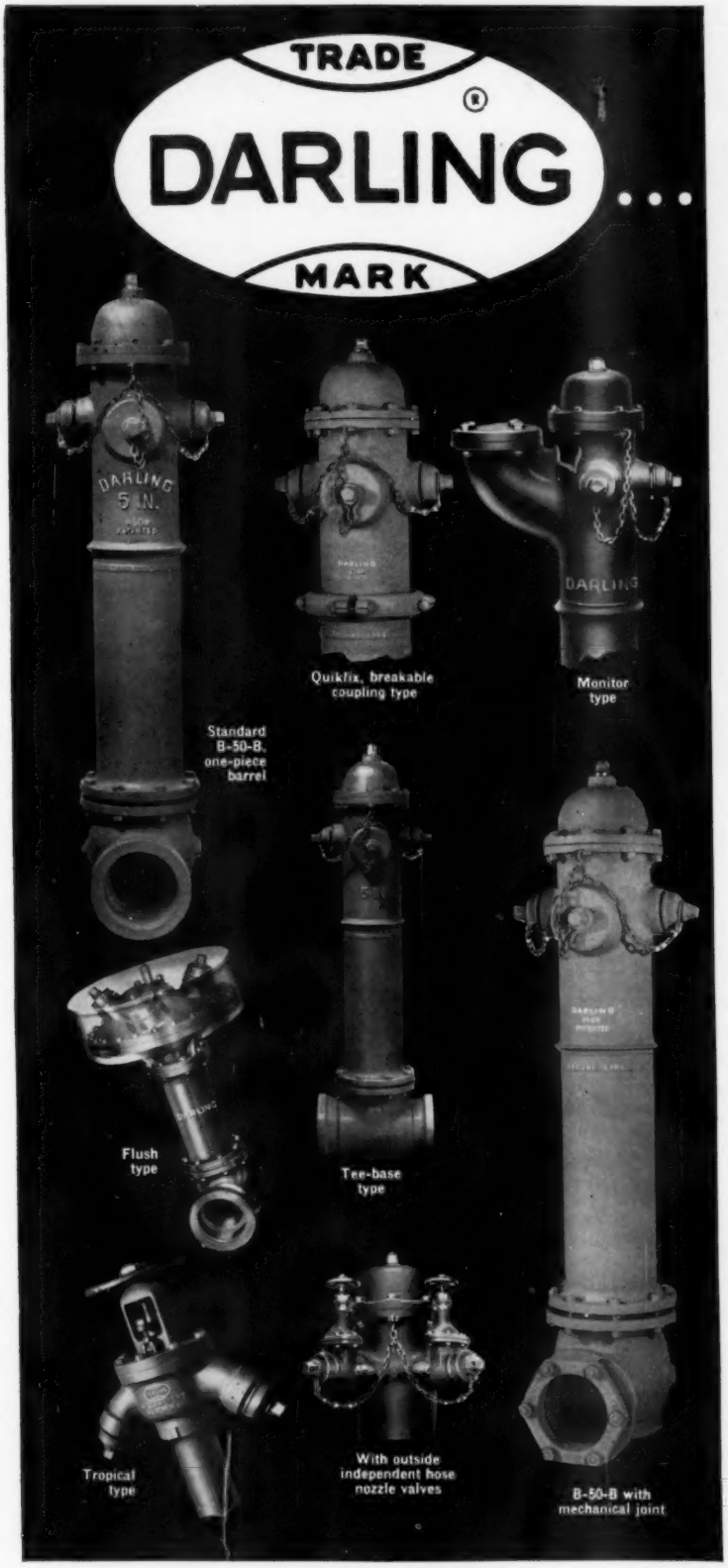
Leaders in Public Works

★

Roy R. Robinson is City Superintendent of Charlevoix, Mich. This position is equivalent to that of City Manager, but the local charter makes no provisions for a manager, though the duties are essentially the same. In addition to the full complement of management functions, he has charge of the electric, water and sewage disposal functions. He has been in Charlevoix since 1953, coming there from Niles, Mich., where he served for ten years. He started back in 1923, in electric utility work, after duty in the Navy in World War I, and attendance at various schools, including Notre Dame, where he studied electrical engineering. In the next 20 years, he accumulated a broad experience in public utility power engineering sales, statistics and rate-making, transmission, distribution and lighting, which has helped a lot in his management work. Somewhere along the way he developed a fine technique in public relations; judging from the materials he has sent us, this Charlevoix must be a most attractive place, despite those Michigan winters: Fish, golf, winter sports, etc.

Mr. Robinson is a registered engineer in Michigan; a member of many technical and professional societies, including AIEE, NSPE, Military Engineers, International City Managers Association and the Michigan Engineering Society. He is a past chairman of the Michigan Municipal Utilities Association; and there is more about him in "Who's Who in Engineering."



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- **Featuring new ball-bearing operated B-50-B design**
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YOU'LL be ahead on many counts when you specify modern Darling Fire Hydrants. Just for example . . .

Your system can include hydrant types exactly right for special or unusual service needs — breakable coupling types where traffic damage is common, concealed flush types for airport and pavement installation, Tee-base types to eliminate lateral connections where practicable. These and a few of the other types are shown here.

Equally important, Darling's unique B-50-B development (now available in all except the Tropical type) introduces *ball-bearing* operation combined with "O" ring seals. Result: a packless, dry-top hydrant. No packing gland maintenance. Operating threads and bearings *stay* lubricated and water can't reach them. Operation is far easier, far faster . . . and you avoid lots of maintenance time and trouble.

Send for complete information. Better still, ask to have a Darling engineer check your needs and tell you just what you stand to gain with Darling Hydrants.

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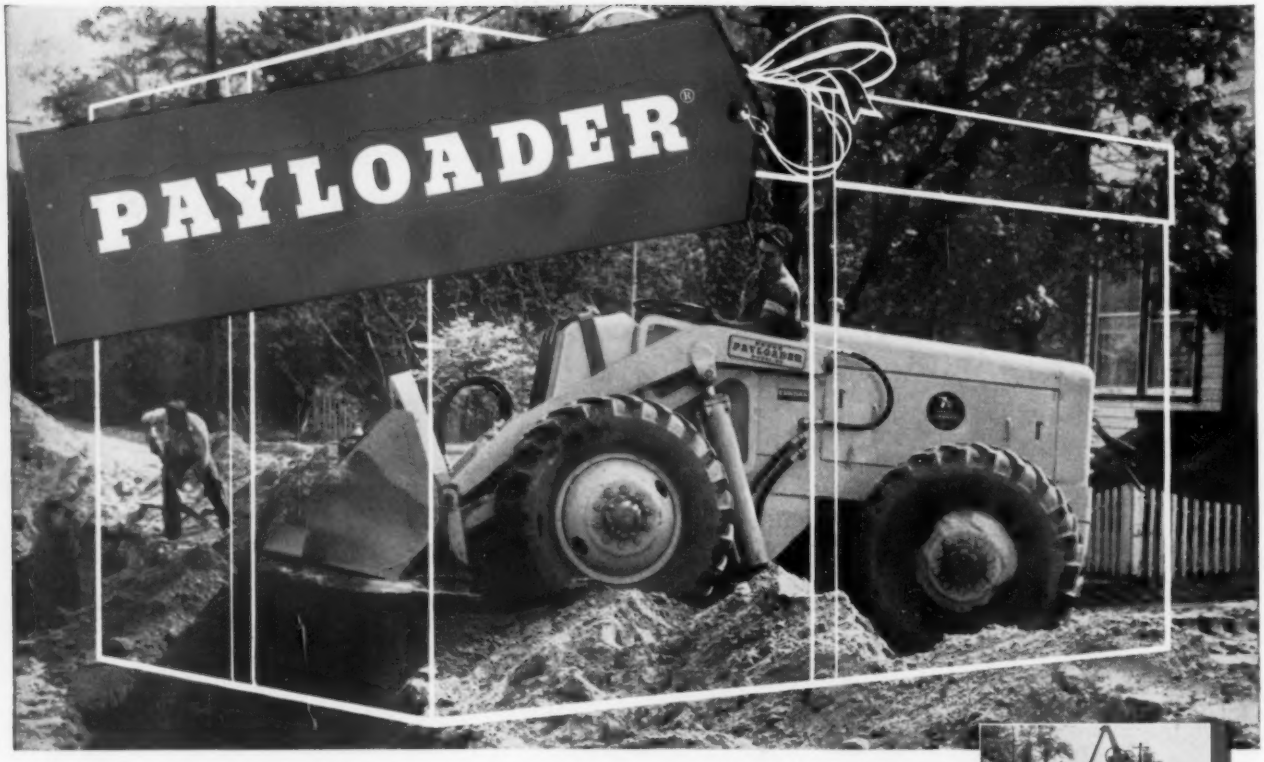
Williamsport 22, Pa.

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ont.

Now's the time to mail this month's Readers' Service card.



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So when you want a package of complete tractor-shovel usefulness — a single machine that can do more jobs on more projects — your best bet is a proven "PAYLOADER". There's a model and size to fit your needs.

BACK-HOE
Dig trenches, tank pits, bell-holes, foundations.

CRANE HOOK
Lift, load, carry and place steel, pipe, timbers, forms — in the yard or on the job.

SNOW PLOWS
Self-powered rotary plows, "V" plows, trip-blade plows—rigid and reversible types.

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Attaches on bucket, dumps its load directly into trucks.

OTHER USEFUL ATTACHMENTS
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Install control valves... connect branch mains... perform a wide variety of other water works operations...under pressure...makes cuts 2" through 12" in any type pipe...25" boring bar travel...working pressures to 500 p.s.i...working temperatures to 550° F... used with Mueller Inserting Valves, Tapping Sleeves and Valves, Gate Valves and special fittings.

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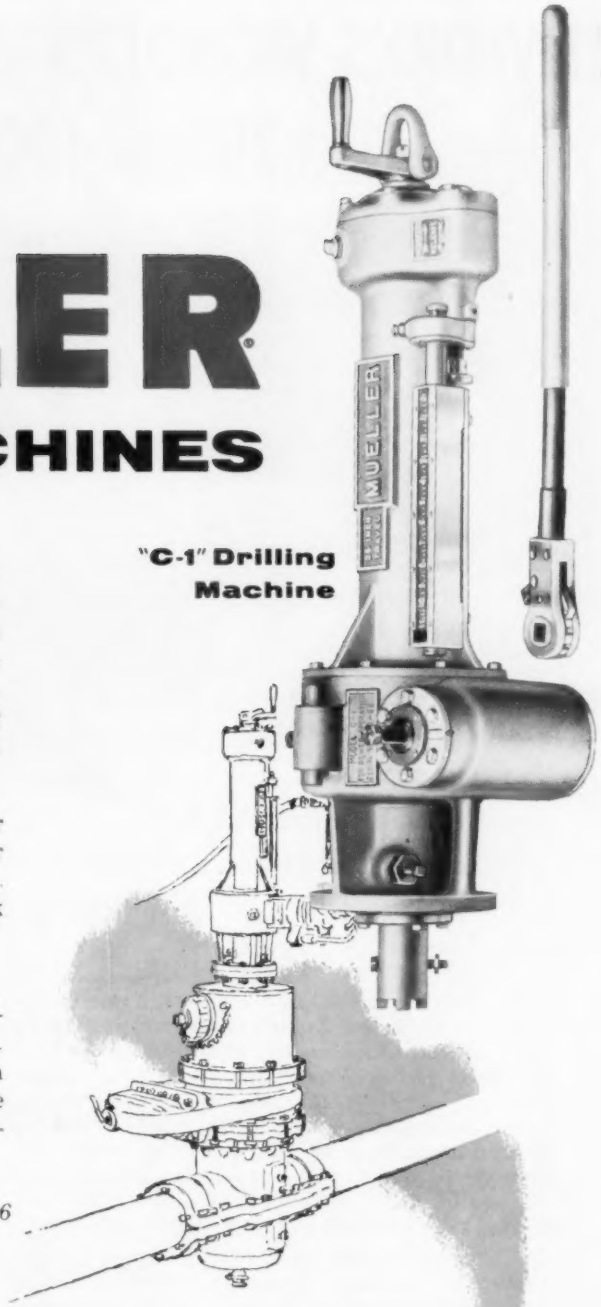
All working parts completely enclosed in tight, oil-filled case... perfect lubrication... free from dirt... telescopic construction for compactness, strength and rigidity... special design prevents line pressure from entering gear case... ball thrust bearings reduce friction and wear... Fully Warranted.

Consult your Mueller Representative, your Mueller W-96 Water Works Catalog or write direct for full details.



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Dependable Since 1857

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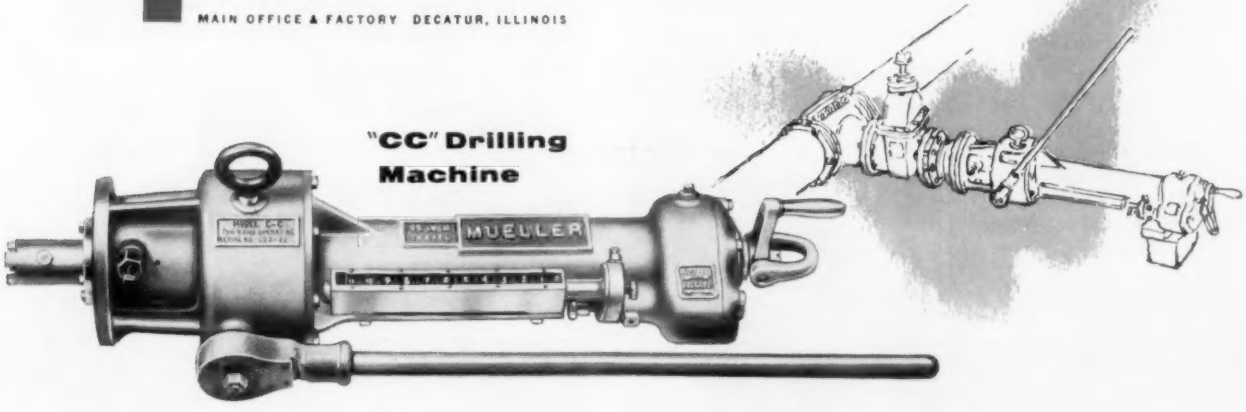

"CC" Drilling Machine

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300 to 400% increase in efficiency

75% decrease in handling costs

One Truck-Mounted
Dempster-Dumpster Handles Scores
of Containers... All Designs... All Sizes

With the Dempster-Dumpster System, one truck-mounted Dempster-Dumpster accomplishes more than several conventional dump trucks. You eliminate trucks standing idle. You eliminate re-handling of materials. You eliminate loading crews. You increase efficiency, sanitation and good housekeeping with this Dempster-Dumpster System—the lowest cost method of municipal bulk trash and rubbish collection ever devised.

It's like having one truck with scores of bodies. One truck-mounted Dempster-Dumpster serves scores of detachable containers. These containers range from 2 to 21 cu. yds. capacity for use with recommended type Dempster-Dumpsters. Each container is designed to meet your requirements. You simply place these containers at convenient trash and rubbish accumulation points outside or inside buildings at hotels, schools, hospitals, business establishments (drug stores, grocery stores, restaurants, etc.), market, housing and apartment areas, etc. As each is loaded, it is picked up on pre-arranged schedule . . . hauled and dumped. Entire operation is handled by hydraulic controls in cab by only one man, the driver.

The list of cost-minded municipalities using the Dempster-Dumpster System includes Asheville, N. C., Atlanta, Lexington, Ky., Baltimore, Birmingham, Boston, Cincinnati, Wyandotte, Mich., Denver, Norfolk, Pensacola, Fla., Richmond, New Orleans and many, many others. Write to us now for complete information. Manufactured exclusively by Dempster Brothers, Inc.

Representatives in principal cities throughout the United States, Canada and foreign countries. There's one near by to serve you promptly.

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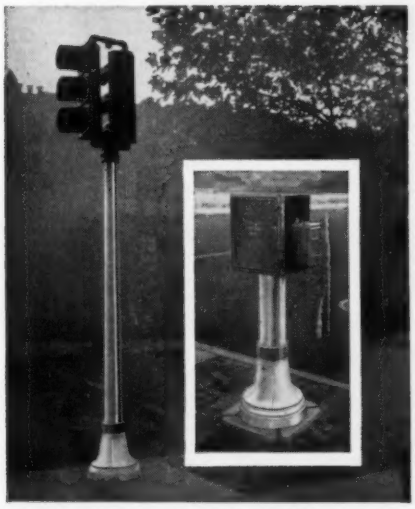
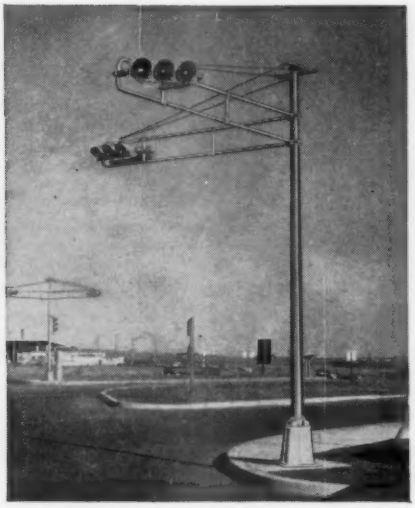
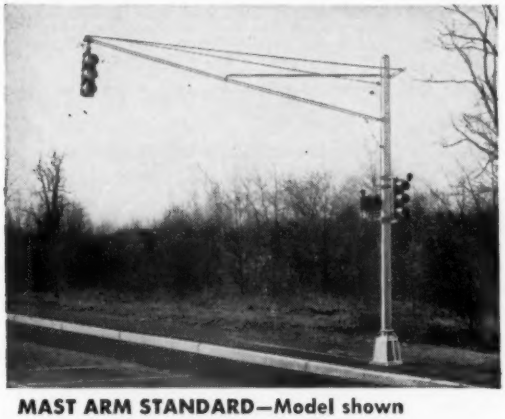


TRAFFIC LIGHT AND CONTROL BOX POSTS—As designed for and being installed in New York City to replace previously used steel posts at an average saving of up to $30.00 per unit.



TROMBONE ARM STANDARD—Equipped with a double and single signal on twin arms with swivel mount for angular adjustments. Available with arms up to 15 feet.

PA SIGN POST—Adjustable type, designed for general use and for electrified signs.



MAST ARM STANDARD—Model shown is equipped with walk-wait pedestrian signals. Supplied with arms up to 25 feet.

P&K all-aluminum maintenance-free standards and posts

P & K IS NOW PRODUCING ALL-ALUMINUM HIGHWAY SIGN SPANS IN A WIDE RANGE OF LENGTHS AND LOADINGS.

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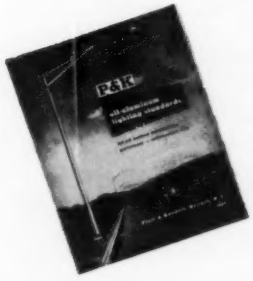

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Engineering Data on the "Cavitator" Waste Treatment System

323. Detailed information on the Cavitator system for secondary treatment of municipal waste is offered by Yeomans Brothers Co., 1999 N. Ruby St., Melrose Park, Ill. Be sure to investigate this system which offers high oxygen transfer efficiency, high performance on relatively low flows and low installation and operating costs. Check the coupon for full data.

Portable Sump Pump Needs No Priming

324. The BJ Pneumatic Sponge Pump, a self-contained air-powered unit, is built for heavy duty dewatering use on all construction jobs. Full details on this lightweight portable sump pump are contained in Bulletin No. 543-3-900, available from Byron Jackson Co., Box 2017, Terminal Annex, Los Angeles 54, Calif., or by checking the coupon.

Points to Consider in Filter Sand Selection

332. Best operation of rapid sand filters requires filter media which is hard, properly shaped, carefully graded and perfectly clean. Filter sand and gravel which meets these exacting requirements is available on short notice from Northern Gravel Company, Box 307, Muscatine, Iowa. Get full details by checking the coupon.

Tractors and Equipment for Municipal Use

337. Specifications for the John Deere "40" crawler and "40" utility wheel tractors, together with equipment for loading, dozing, mowing, sweeping and many other operations is covered in a comprehensive illustrated catalog issued by John Deere, Dept. 66B, Moline, Ill. Get your copy by checking the coupon.

Engineering Guide to Mercury Street Lighting

380. Basic engineering aspects of mercury vapor street lighting are discussed in a 35-page Engineering Guide available from Westinghouse Corp., Box 2099, Pittsburgh 30, Pa. This practical reference includes technical data on mercury lamps applicable to general lighting service, operating characteristics of the system and a discussion of methods of economic evaluation of alternative lighting systems. Check the coupon for your copy of this helpful guide.

Engineering Data on Asbestos Cement Pipe

372. Advantages of corrosion-free asbestos-cement pipe for water distribution plus full data on installation methods, cutting, making connections, testing, dimensions and weights are contained in the bulletin, and "Mains Without Maintenance," issued by Keasby & Mattison Co., Ambler, Pa. Get your copies by checking the coupon.

Tunnels Do It Better

382. Advantages of tunneling to avoid the interference of open trenching under highways, streets and railroads are discussed in a folder issued by Armco Drainage and Metal Products, Inc., Middletown, Ohio. Installation data and specifications on Armco Liner Plates for tunnels and conduits are included. Check the coupon for your copy.

Data on Diatomaceous Earth Filters for Swimming Pools

390. Engineering data on Purecel Filters for clarifying swimming pool water is offered in Sup. Bulletin 1800-3 by Proportioneers, Inc., 345 Harris Ave., Providence 1, R. I. Advantages, operating details, piping installation drawing and size selection table are included. Get your copy by checking the coupon.

Better Drainage for Streets and Highways

358. Irving "Dryway" Draingrates provide maximum drainage openings for catch basin inlets, across-the-road drains and centerline drains. Light weight, strength, economy and corrosion resistance are a few of the many features offered. Full descriptive details on both riveted and pressure locked type are furnished in an illustrated bulletin by Irving Subway Grating Co., Inc., 50-09 27th St., Long Island City 1, N. Y. Check the coupon.

Reference Data on the Electric Check Valve

344. Comprehensive data on the new Double Cushioned Electric Check Valve which simplifies backflow control at pumping installations is contained in an 8-page technical bulletin, issued by Golden-Anderson Valve Specialty Co., 1244 Ridge Ave., Pittsburgh 33, Pa. Details on valve design for quiet, positive operation, dimensions, wiring arrangements and head loss are included. Check the coupon for Bulletin W-10.

Self-Propelled Sidewalk Paver Lays Up to 10 Ft. per Minute

117. Bulletin 52, released by Dotmar Industries, Inc., Kalamazoo, Mich., describes the Dotmar paver, which can lay up to 10 ft. per minute of walk when working with transit mix units. Paver is readily convertible to pave curb and gutter, or integral curb, gutter and walk. Get the 8-page illustrated bulletin for full data and reports from users. Just check the handy coupon.

MORE LISTINGS ON PAGES 34 TO 49

Comprehensive Bulletin on Swimming Pool Equipment

73. Fully illustrated 12-page Bulletin WC-109 of the Graver Water Conditioning Co., 216 West 14th St., New York 11, N. Y., gives complete descriptions of modern filtering and recirculating equipment and accessories for the treatment of swimming pool water. Many indoor and outdoor pools and their equipment are illustrated, and typical flow diagrams show engineering details. For your copy check the coupon today.

Tips for Installing Orangeburg Pipe

336. Good practice for installation of Orangeburg pipe and fittings is outlined in an illustrated four-page bulletin made available by the Orangeburg Mfg. Co., Inc., 488 Madison Ave., New York 22, N. Y. Trenching and backfilling, pipe laying, cutting and connecting with other types of pipe are included. Use the coupon for your request.

4-55

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on products and materials mentioned in this issue. Circle numbers below and mail today.

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Super new power . . . features . . . value!

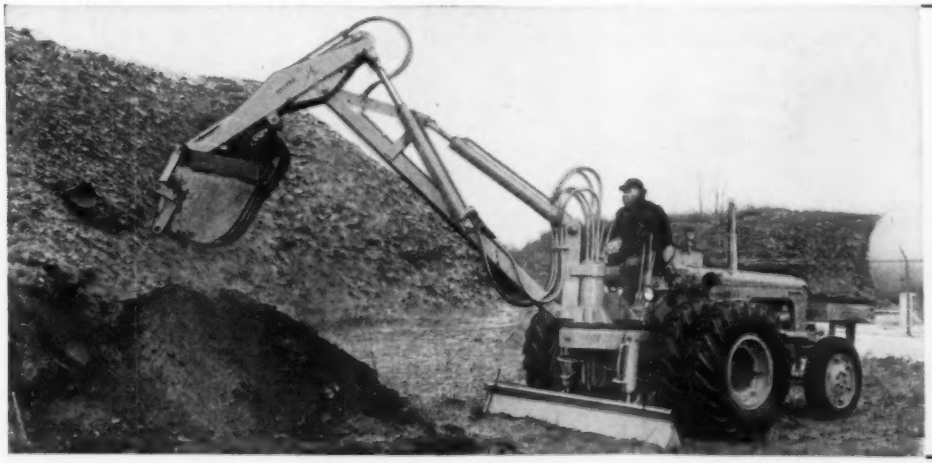
Here are the newest tractors in the industrial field—the Oliver Super 77 and 88!

Here is power like never before. And both Supers offer a choice of gas or diesel engine. The gas engine has a compression ratio of 7.0:1 to give you more power on less fuel. And the diesel is a full diesel—starts and runs on diesel fuel alone. Pick the fuel that fits your work, saves the most.

Here are tractors that have the features you want—five working speeds, one road speed; long-lasting double-disc brakes; easy ball-type steering; comfortable rubber spring seat; Independent Rear Power Take-Off and many other advancements found only on Oliver Supers.

These tractors take a variety of equipment . . . are useful on hundreds of different jobs. Test them yourself. Find out why an Oliver Super is your best buy for power, features and value—now, and for years to come! See your Oliver Industrial Distributor for a demonstration.

THE OLIVER CORPORATION
400 W. Madison Street, Chicago 6, Illinois
A complete line of industrial wheel and crawler tractors



Oliver Super 88 with HydroTrencher. This trencher has a ½-yard capacity and quick, positive hydraulic control. It digs to 12 feet, loads to 12 feet.

To order these helpful booklets check the coupon on page 32.

How to Design Stabilized Bases Using Bitumuls Emulsified Asphalt

379. "Bitumuls for Base Construction" is the title of a 12-page booklet discussing the use of Bitumuls emulsified asphalt for this phase of pavement construction. Step-by-step outline covers laboratory tests of soils. Bitumul quantity requirements, construction procedures and advantages. Your copy is available. Write to American Bitumuls & Asphalt Co., 200 Bush St., San Francisco 4, Calif., or check the coupon.

Data on Transformers for Mercury Lamp Street Lighting

34. Helpful technical information on transformer selection to provide more lumens per watt, less maintenance and longer life in mercury lamp installations is furnished in 16-page Bulletin No. 551-5 of the Jefferson Electric Co., Bellwood, Ill. General information, lamp data, diagrams and illustrations of transformers for both multiple and series circuits are included. A helpful reference for all engineers and superintendents concerned with street lighting. Check the coupon for a copy.

Tables Simplify Selection of "Flush Kleen" Sewage Ejectors

386. "Flush Kleen" selection is made easy by a series of engineering tables offered in Bulletin 123 by the Chicago Pump Co., 622 Diversey Pkwy., Chicago 14, Ill. Station types, flow determination, pump capacity and procedures for determining total dynamic discharge heads are outlined in detail. Get this useful reference by checking the coupon.

Everett Trencher Mounts on Wheel Tractor

388. The mobile tractor mounted Everett trencher digs clean, smooth trenches up to 5 ft. deep as fast as 300 ft. per hour, works close to walls and obstructions, casts dirt to either side. For more details on these and other features plus full specifications get bulletin on the Model 60 trencher from Earth Equipment Corp., 2036 Sacramento St., Los Angeles 21, Calif. by checking the coupon.

How A Diatomite Filter Works

384. The three main steps in diatomite filter operation—precoating, filtering and cleaning are discussed and clearly illustrated with specially prepared drawings in Bulletin No. 5502 of the General Filter Co., Box 11, Ames, Iowa. Get this interesting bulletin by checking the coupon.

Latest Information on Tandem Rollers

104. The tandem roller line of Huber-Warco Co., including 5-8, 8-10, 8-12 and 10-14 ton models, is covered in 16-page Bulletin HWT-501. Cross-sections, diagrams and photos point out principal engineering features which mean top performance and ease of operation. For a copy of this bulletin write Huber-Warco Co., Marion, Ohio, or check the coupon.

Fast Marker for Traffic Guide Lines

155. Free-floating, adjustable paint shields on the Mark-Rite Econo-Liner follow surface contours and produce sharp lines in any width from 2" to 6". This machine is said to paint 10,000 to 15,000 feet of line per hour. For details get Form E-100 from Universal Mfg. & Sales Co., 5211 Pacific Blvd., Huntington Park, Calif.

Efficient Material Handling to Reduce Incineration Costs

148. Blaw-Knox Buckets specially designed for refuse and garbage handling are described in 22-page Bulletin 2350-R. Illustrations show progress of material through a modern municipal incinerator plant. Dimensions and incinerator bucket specifications are included. Blaw-Knox Div., 2124 Farmers Bank Bldg., Pittsburgh 22, Pa.

Compact Flow Tube for Measurement and Flow Control

401. The Gentile Flow Tube is a primary metering element (differential producer) designed for accurate measurement and indication of flow. Handles reverse flow and is reproducible. An individual calibration curve is furnished with each tube. Available with secondary indicating, recording or totalizing instruments. To get Bulletin F-T write Foster Engineering Co., Union, N. J. or check the coupon.

Latest Traffic Signal Data

400. Full data on Marbelite adjustable traffic signals is available from The Marbelite Company, Inc., 27 Warren Street, New York 7, N. Y. To get latest information write direct to the company or check the handy coupon.

Helpful Data on Distributors for Bituminous Materials

402. Pressure distributors featuring uniform pressure and temperature, accurate displacement pumping, convenient operation are described in literature of Standard Steel Works, North Kansas City, Mo. Data on new model for maintenance and seconda y road construction will be included. Check the coupon.

How to Save on the Cost of Signs

405. Sign costs have been reduced significantly by many cities, counties and states that switched to Alcoa aluminum for signs and markers. Strength and corrosion resistance cut maintenance costs; aluminum fasteners mean trouble-free installation. For full material specifications write Aluminum Company of America, 1978-D Alcoa Bldg., Pittsburgh 19, Pa., or check the coupon.

Better Mowing and Brush Removal

403. Fast, versatile tractor drawn Wood rotary mowers are available in a large selection of models to suit all types of municipal and highway department maintenance requirements. Be sure to investigate these units and discover how costs of roadside mowing, brush cutting, leaf mulching and park maintenance can be reduced with efficient equipment. Get full details by checking the coupon or from Wood Bros. Mfg. Co., Oregon, Ill.

New **NETCO Catch Basin Cleaners are Working Throughout the Land in These Cities**

Chicago, Illinois
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Grand Rapids, Mich.
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City of N. Y., N. Y.
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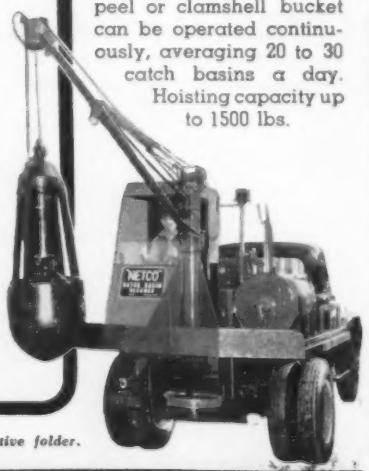
Easily mounted on any short wheel base truck with 8 ft. in back of the cab, the NETCO with orange peel or clamshell bucket can be operated continuously, averaging 20 to 30 catch basins a day. Hoisting capacity up to 1500 lbs.



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NETCO DIVISION
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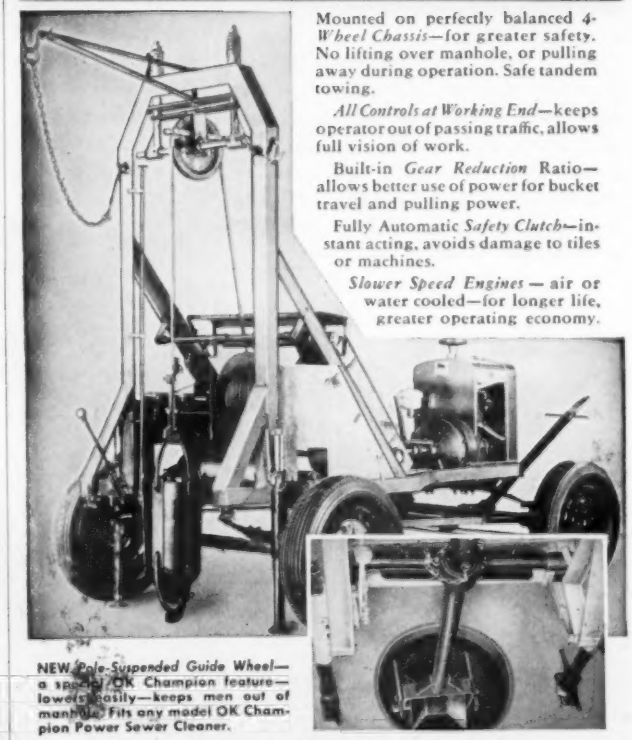
OK CHAMPION POWER SEWER CLEANERS



Mounted on perfectly balanced 4-*Wheel Chassis*—for greater safety. No lifting over manhole, or pulling away during operation. Safe tandem towing.

All Controls at Working End—keeps operator out of passing traffic, allows full vision of work.

Built-in *Gear Reduction* Ratio—allows better use of power for bucket travel and pulling power.

Fully Automatic *Safety Clutch*—instant acting, avoids damage to tiles or machines.

Slower Speed Engines—air or water cooled—for longer life, greater operating economy.

NEW *Pole-Suspended Guide Wheel*—a special OK Champion feature—lowers easily—keeps men out of manhole. Fits any model OK Champion Power Sewer Cleaner.

Write for latest OK Champion Circular

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The Barber-Greene is easily adjusted to increase or decrease its normal laying width of 10 feet. Dual controls. Heated screed. Large receiving hopper. Complete thickness control of over-all width, center, or either side.

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PAVE with automatic leveling. **PAVE** with positive traction.

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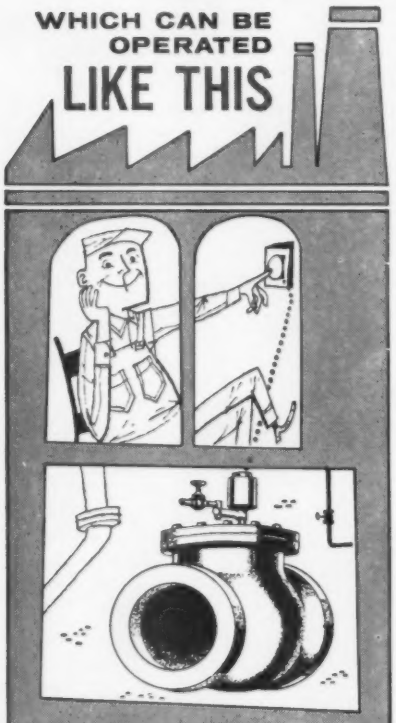


✓ or by many other types of electrical impulse

✓ Use the angle body and save the price of an elbow fitting

✓ Positive Control

✓ Sizes ½" thru 36"

✓ Used on Water, Oil, Air and Many Other Liquids

BULLETIN W-7 HAS THE TECHNICAL FACTS
WRITE FOR IT TODAY

GOLDEN ANDERSON
Valve Specialty Company
1244 RIDGE AVE., PITTSBURGH 33, PA.
Designers and Manufacturers of VALVES FOR AUTOMATION

NEW LISTINGS (cont.)

Combat Unpleasant Odors At Municipal Sanitation Sites

404. Malodors at municipal refuse disposal sites, waste treatment plants and incinerators may be effectively "neutralized" by the odor masking products of Rhodia, Inc. Be sure to investigate this means of eliminating complaints from unpleasant odors. Write Rhodia, Inc., 230 Park Ave., New York 17, N. Y. or check the coupon.

Comprehensive Bulletin Covers All Sign Needs

406. Data on warning and regulatory signs, street name signs, devices, posts and reflector buttons are furnished in comprehensive Catalog 54 of the Cataphote Corp., Toledo 10, Ohio. You'll find information on all your sign needs, including button, sheeting and beaded reflectorization in this helpful booklet. Get your copy by checking the coupon.

●

WATER WORKS

Data on Cutting-In Valves, Repair Sleeves and Accessories

33. A variety of Clow products for installation and repair of cast iron pipe lines, including the Eddy cutting-in valve and sleeve, split sleeves for pipe repair, test plugs, valve boxes, Strickler pipe cutters and other fittings and accessories are featured in literature available from James B. Clow & Sons, Inc., Box 6600-A, Chicago 80, Ill. Check the coupon.

Technical Data on Fluorides And Other Chemicals

48. Technical data on fluorides and other chemicals will be found in a comprehensive booklet issued by Blockson Chemical Co., Joliet, Ill. This helpful 60-page booklet includes a great deal of general information of value to water works men. Get a copy by checking the coupon.

Helpful Data on Water Works Products

49. A completely new catalog covering the entire line of water distribution and service products offered by the Mueller Company, of Decatur Ill., is now available to engineers and water works superintendents. The 328-page catalog features an easy-to-use sectional indexing arrangement to facilitate quick reference to any of the hundreds of products liated. A large section of useful engineering information is included. Check the coupon today.

Meter Features That Help Make Water Works Profitable

59. Simple design, accuracy and long life, moderate first cost and inexpensive maintenance are features of American water meters described in Bulletin No. 55 of the Buffalo Meter Co., 2917 Main St., Buffalo 14, N. Y. Be sure you have this informative booklet which gives the details of American meter design and construction plus full data on sizes, capacities and dimensions. Get your copy by checking the coupon.

Convenient Reference Manual Covers Cast Iron Pipe, Valves and Hydrants

76. An 80-page manual, issued by R. D. Wood Co. Independence Sq., Philadelphia 5, Pa., presents specifications for "Sand-Spun" cast iron pipe and fittings, outlines types of joints available, lists dimensions and weights in convenient tables and includes, in addition, full engineering data on the Mathews fire hydrant and R. D. Wood gate valves. Check the coupon for this useful information.

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers. Requests for this valuable booklet must be made on business letterhead.

Design Data on Chemical Flocculating Equipment

89. Flash mixers, Straightline mixers, conveyors and elevators for handling chemicals are described in illustrated Bulletin No. 2442 available from Link-Belt Co., Colmar, Pa. Selection tables and diagrams are provided to help you select the equipment best suited to your needs. Check the coupon for your copy.

General Catalog Covers Process Instrumentation

138. A 12-page general catalog which illustrates, describes and gives basic specifications for Fischer & Porter Company's complete line of process instrumentation is now available. This convenient reference gives data on instruments for measuring and controlling flow, pressure, liquid level and other variables and transmitting, recording and integrating measures. Check the coupon for your copy.

Get Data On Magnesium Anodes For Corrosion Protection

161. The use of magnesium anodes to protect pipe lines and other structures from the corrosive effects of aggressive soils is discussed in the bulletin "Plug Corrosion Leaks" issued by Pipe Line Anode Corp., Tulsa, Okla. To get this interesting literature, prepared by anode specialists, just check the coupon.

What You Should Know About Steel Reservoirs and Standpipes

163. In a handsome 24-page booklet "Horton Steel Reservoirs and Standpipes," the Chicago Bridge & Iron Co., Chicago 4, Ill., shows installations from 50,000-gal. to 10,000-000-gal. capacity with several types of roof and special architectural features. Engineering data includes information on capacities, foundations and improved surface protection. Check the coupon to get your copy.

What You Should Know About Turbine Pumps

167. In a colorful bulletin titled "Water Where You Want It . . . When You Want It" the Johnston Pump Co., Bin "K", Pasadena 8, Calif., gives details on turbine pumps with semi-open or closed impellers; oil or water lubrication; and adaptations for any power source or combination thereof. Get your copy of Bulletin 1015 by checking the coupon.

Engineering Data On Gravity Filter Design

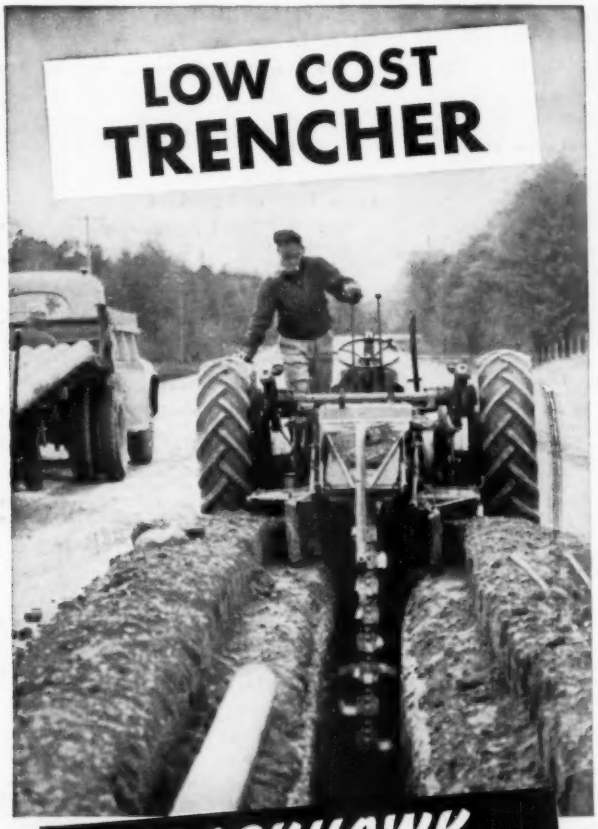
170. The complete line of gravity filters and related accessories furnished by the Permutit Co., New York 36, N. Y., is covered in a well-illustrated 24-page booklet. Each element of a filter and filter controls are discussed in detail to assist the designer of these important units. Get your copy of this helpful publication by checking the coupon.

Engineering Data on Tilting Disc Check Valves

196. The Chapman tilting disc check valve is designed to lift away from the body seat without sliding or wearing; closes without slamming. Operating principles, details of construction, dimensions, recommendations and engineering data are fully covered in 18-page Bulletin No. 30. Get your copy by checking the coupon or write to Chapman Valve Mfg. Co., Indian Orchard, Mass.

Tablet Hypochlorinator Offers Extra Convenience

262. Economy, safety and convenience plus accurate dosage control are offered by HTH tablets and the tablet hypochlorinator. The principles of operation, applications and details on three hypochlorinator models which provide a range of dosage rates are covered in a 26-page bulletin, available from Olin Mathieson Chemical Corp., Industrial Chemicals Div., Baltimore 3, Md. Check the coupon for your copy.



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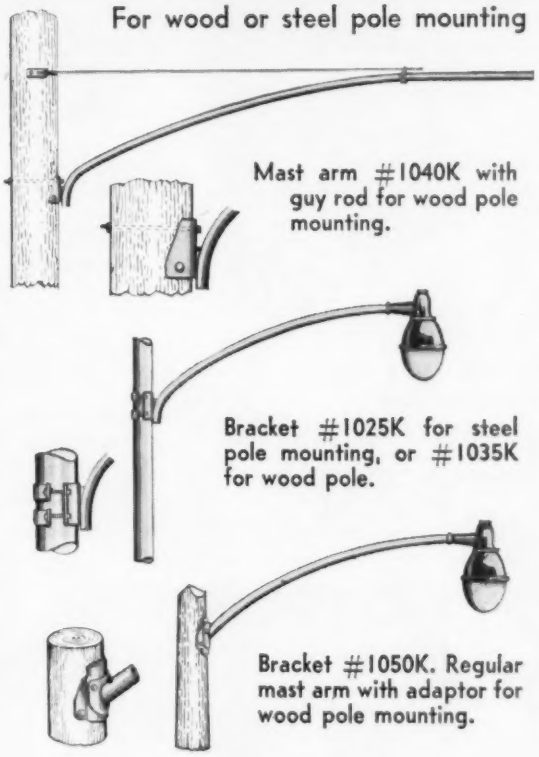
Steel Brackets & Mast Arms

For Economy & Beauty

For wood or steel pole mounting



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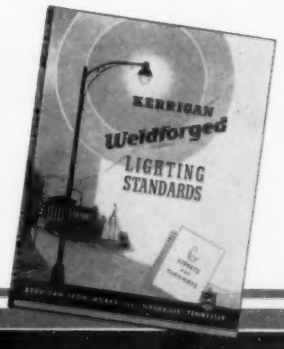

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Now's the time to mail this month's Readers' Service card.

Installation Guide for Transite Pressure Pipe

192. An convenient, pocket-size book of 115 pages covers the whole job from receiving and handling pipe to pressure and leakage tests of finished lines. Over 10 drawings show important operations, and the text tells both how and why. Copies are available from Johns-Manville, Dept. PW, 22 E. 40th St., New York 16, N. Y.

What You Should Know About The Centriline Process

197. The Centriline method for cement mortar lining water mains 16" thru 144" in place to stop leaks, prevent corrosion, increase carrying capacity and decrease pumping costs is fully described in a handsome booklet issued by the Centriline Corp., 140 Cedar St., New York 6, N. Y. Many illustrations and typical case histories show the operation and economies of this process. The Tate process for lining smaller mains is also covered. Check coupon for your copy.

Are You Ready Now To Make Main Repairs?

214. Broken water main can quickly be repaired when you have "Skinner-Seal" Split Coupling Clamps on hand. Leaky bell and spigot joints are made lastingly tight with Skinner-Seal Bell Joint Clamps. Get Skinner Catalog GW now—this handsome 48-page book shows how to make every type of pipe repair and covers a complete line of clamps to do the job quickly and easily. Just check the handy coupon for your copy.

What You Should Know About Fluoridation

217. A helpful publication entitled "Fluoridation" which describes the development of fluoridation and lists the chemicals and dosages normally used has been prepared by Wallace & Tiernan Inc., 25 Main St., Belleville 9, N. J. Copies of publications on both solution and dry feed W&T Fluoridators are also available. These publications are yours for checking the coupon.

Engineering Data on Diatomite Filters

139. Get complete data on the Sparkler model SC-J diatomite slurry feed filter for swimming pools from the Sparkler Mfg. Co., Mundelein, Ill. Check the coupon for full information including table of filter sizes and capacities, space required and filter operation.

Data on Builders Butterfly Valves

172. Information on the newly expanded line of tight-closing rubber-seated butterfly valves made by Builders-Providence, Inc., 345 Harris Ave., Providence, R. I. is available in Bulletin 650-LI. General arrangement dimension prints and data on valve operators are included. Check the coupon for your copy.

Investigate This Compact Flow Meter for Water

226. The Foster "Flow Tube" is a metering element that is compact and easy to install. Bulletin FT illustrates simple element containing nozzles for differential pressure production and shows capacity range and accuracy. Made in standard type sizes. Foster Engineering Co., Union, N. J. will send copy, or use coupon.

Helpful Valve Catalog For Engineers

236. For complete descriptions of Darling double disc, parallel seat gate valves be sure to get Bulletin 5403 issued by Darling Valve & Mfg. Co., Williamsport, Pa. Construction details covering all valve parts and accessories are helpful for specification writers. Check the coupon for your copy.

Data On Efficient Mechanical Pipe Joints

396. "Bolite" standardized mechanical joint pipe lays fast, joints are quickly made, are flexible and durable. For full details on this equipment write McWane Cast Iron Pipe Co., Birmingham, Ala., or check the coupon.

Standard Specifications for C. I. Pipe and Fittings

278. Standard dimensions for cast iron water pipe and special castings are available in convenient booklets offered with the compliments of U. S. Pipe and Foundry Co., Birmingham 2, Ala. Get your copy by checking the coupon.

Cleaning Service for Every Type of Pipe Line

302. Flexible Pipe Cleaning Co., operating with specialized equipment and trained crews, is prepared to remove scale, rust and other deposits from pipes for every type of service. For details and estimates furnished without obligation write Flexible Pipe Cleaning Co., Box 167, Los Nietos, Calif. or check the coupon.

Modern Filtration of Swimming Pool Water

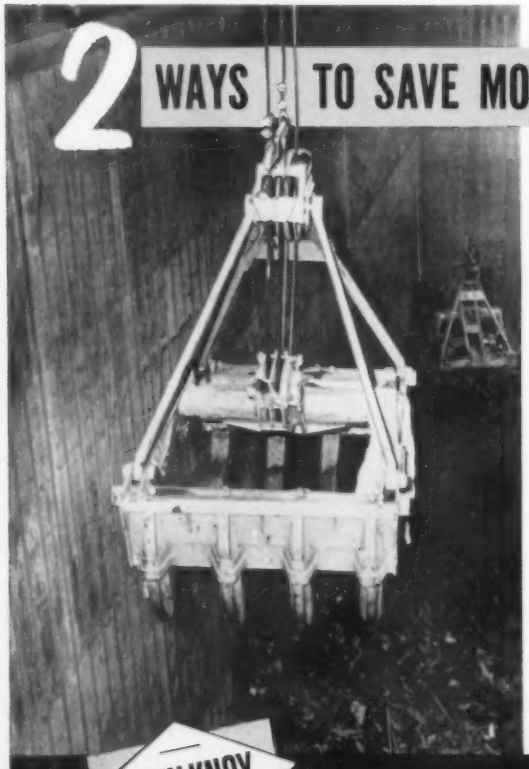
351. Latest data on filtration systems for swimming pools of 50,000 gallon capacity and over is presented in 24-page bulletin No. 625 by R. P. Adams Co., Inc., 225 East Park Drive, Buffalo 17, N. Y. Design and operating data are provided, together with material to assist you in choosing the right filter for your pool. Check the coupon for your copy of this helpful bulletin.

All About Centrifugal Pumps

361. Where pumping performance counts you want to check your specifications carefully. Investigate the features of Fairbanks-Morse centrifugals. Use coupon or write to Fairbanks, Morse & Co., Dept. P. W., Chicago 5, Ill.

Helpful Data on Swimming Pools

364. Data on injector nozzles for complete recirculation, fittings for correct drainage and other useful information for pool design are covered in Manual SP issued by Josam Mfg. Co., Michigan City, Ind. Check coupon for your copy.



2 WAYS TO SAVE MONEY IN OPERATING YOUR INCINERATOR

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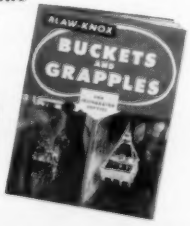

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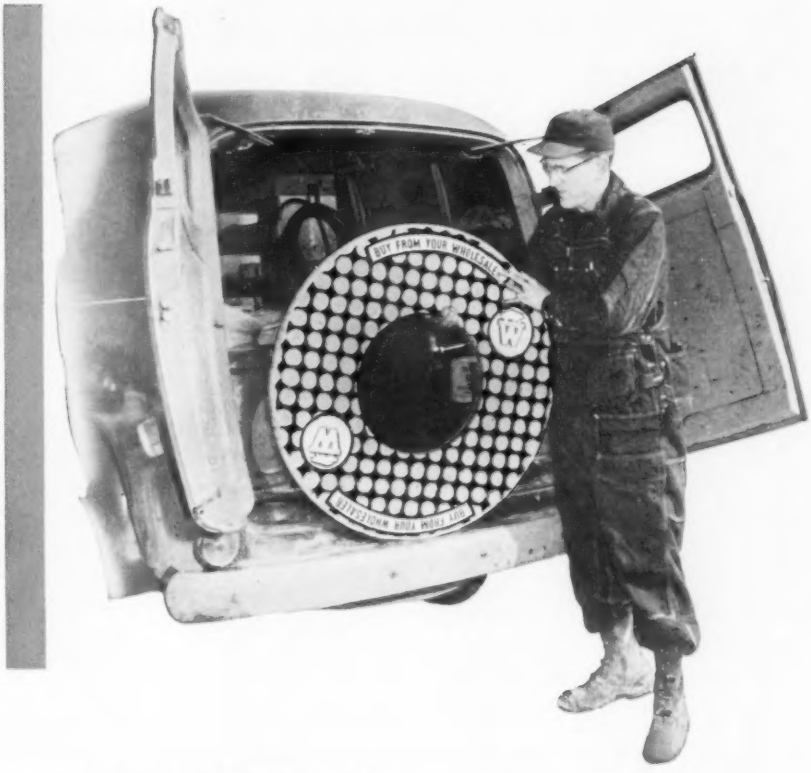

There are plenty of plus values for copper tube users in Wolverine's new round carton.

At last—a roll of tube that rolls! In addition, the carton has a hole in the middle and can be carried easily or used as a reel.

An easy tug on the gummed tape lets you get at the tube. *There's no tearing or other destruction of the carton.* You can reel out the tube you need—cut it off—and leave the remainder protected in the carton.

The sturdy carton (it has a corrugated core for extra protection) has color-coded tape for quick identification of the tube from any angle.

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Best of all, you get the same top-quality Wolverine copper tube you've grown so used to. That means your jobs will stand up under tough conditions—more customer satisfaction.

Your wholesaler has this carton in stock right now. *Insist on it.* WOLVERINE TUBE, 1427 Central Avenue, Detroit 9, Michigan.

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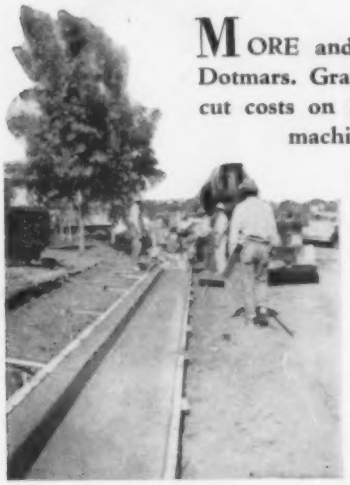
DOTMAR CURB, GUTTER and SIDEWALK PAVERS are Cutting Costs Coast to Coast!



MORE and more contractors are cutting costs with Dotmars. Granite Construction Co., Watsonville, Calif., cut costs on 14 miles of integral curb and gutter with machine shown. Pays for itself in first mile of paving. Lays 5 to 10 lineal ft. per minute. Any shape curb or gutter. Greater concrete yield. Simple extension for paving sidewalks. Send for Bulletin 53.

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Weighs only 3½ lbs. 7" long. Fits hand like a pistol. Power like a cannon. For drilling concrete, shipping, caulking, riveting, sheet metal cutting. Only $49.75. Send for Bulletin 154.

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STREETS AND HIGHWAYS

Do You Have Complete Black Top Equipment Data?

41. In 36-page catalog AA a full line of maintenance is covered. Units described and illustrated include several models of pressure distributors, supply tanks, sprayers, brooms, asphalt kettles, portable rollers, and accessory tools. Use coupon for copy of this handy manual. Littleford Bros., 452 E. Pearl St., Cincinnati 2, Ohio.

Convenient Source of Rubber for Road Improvement

128. "Surfa-Seal" Pellets, made in the form of small cubes containing 40% rubber hydrocarbons are now available for improving asphalt stability, providing low temperature flexibility and reducing hardening and stripping. A booklet which covers these advantages in detail and tells how the pellets are used and quantities required is offered by Naugatuck Chemical Div., U. S. Rubber Co., New York 20, N. Y. Just check the handy coupon.

Now Every Municipality Can Own a Trencher

173. The low cost of the Blackhawk Trench Hog, a tractor-mounted ladder type trencher makes it profitable for many municipalities to own their own trencher. Be sure to investigate this versatile machine which digs trenches to 8 feet deep, 20 inches wide. Illustrated bulletin available from Arps Corp., New Holstein, Wis. Just check the coupon.

For Prompt Service Use The Coupon

How the "Payloader" Helps Public Officials

190. An attractive new booklet "Getting More for the Tax Dollar with Payloaders" makes worthwhile reading for every public official in charge of construction and maintenance of roads, streets, and utilities. You will find illustrations and data showing dozens of ways the "Payloader" is used by cities, counties and states, plus convenient specifications on seven models. Check the coupon or write Frank G. Hough Co., 761 Seventh St., Libertyville, Ill.

Windrow Loader is Tailor Made for Majority of Highway Needs

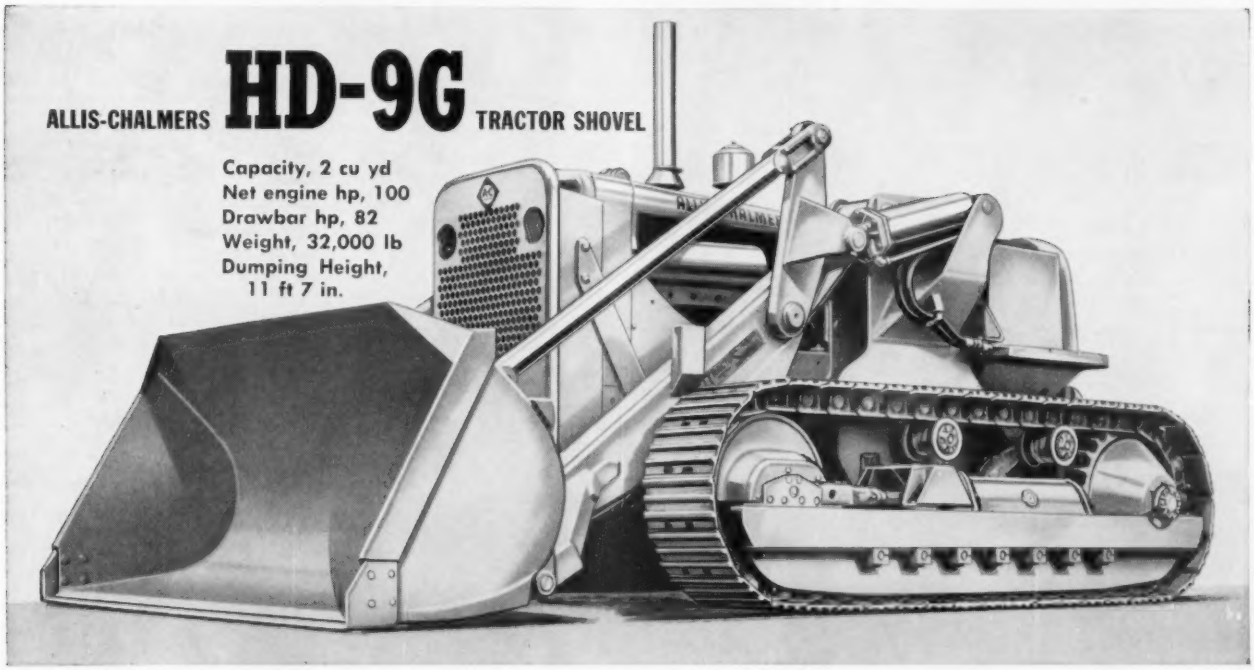
296. The peculiar problems of windrow loading require in most cases a medium capacity, low cost, highly maneuverable machine. To meet these needs Barber-Greene Co. now has a 4 cu. yd. per min. Windrow Loader, mounted on a John Deere wheel tractor. Further details may be obtained from Barber-Greene Co., Aurora, Ill. by checking the coupon.

A Helpful Booklet For Those Who Build and Maintain Roads

310. "Governmental Graders," a booklet published especially for the 18,000 governmental agencies with jurisdiction over local-rural roads tells how the three sizes of "Cat" motor graders do the job on road building and maintenance programs. Of particular interest is a table of repair costs compiled from public records. Get your copy from the Caterpillar Tractor Co., Peoria 8, Ill., or by checking the coupon.

Latest Data on Performance Tested Sweepers

322. Be sure to investigate the outstanding features of Wayne motor pick-up sweepers, fully described in literature of the Wayne Manufacturing Co., 1201 East Lexington St., Pomona, Calif. Effective sweeping, speed, maneuverability and operator convenience are backed up by performance records. Get latest data by checking the coupon.

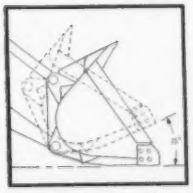


POPULAR 2-YD HD-9G TRACTOR SHOVEL NOW OFFERS

Higher Work Capacity

Design refinements in the Allis-Chalmers HD-9G now make it even more productive than ever. First, the net engine output has been increased to 100 hp, with 23,000 lb of push for extra crowding and digging ability, fast work cycles.

Streamlined bucket design now helps roll in large loads with less tractor effort. The back of the bucket has been brought forward and the sides extended to cut spillage, put more pay load where it's wanted. Cleaner dumping with the new bucket saves the operator time and effort shaking out loads.



A new addition to the wide variety of attachments available for the HD-9G Tractor Shovel is the Tip-Back bucket which allows the operator to roll the bucket back approximately 25° at ground level. Ideal for handling greater capacities of loose stockpiled materials, the Tip-Back bucket can be carried lower to the ground for greater stability . . . can load bulky objects easier.

New-type ceramic master clutch lining reduces lever pull, makes it easier for the operator to do more. The new HD-9G helps the operator do more in other ways, too — giving him full vision, fast and easy control, cleaner platform and more comfortable seat from which to work, and more working time with truck wheels, support rollers and idlers that need greasing only once every 1,000 hours.

Lower Operating Cost

Design improvements also add longer life to the HD-9G under all work conditions. Heavy box-section booms are 50 percent stronger, assuring proper alignment even working in the toughest materials. The low design of the new HD-9G combination stabilizer and cowl not only offers easy accessibility for maintenance and service, but contributes to maximum operator vision. New ceramic master clutch lining operates longer between adjustments, increases clutch life.

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Heavy-duty truck wheels and idlers are available for particularly tough working conditions. One-piece, full-length main frame permits unit construction so that major assemblies can be removed without disturbing adjacent units, putting tractor back on the job in hours rather than days.

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See your Allis-Chalmers dealer for further information on what the HD-9G can do for you — or a demonstration right on your job.

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Need more facts about advertised products? Mail your Readers' Service card now.

To order these helpful booklets check the coupon on page 32.

How to Save Time on Curb and Gutter Work

143. Every type of curb and gutter work is illustrated in the 12-page Heltzel catalog on steel forms for building concrete curbs, gutters and sidewalks. Time-saving setups show how to speed up the job and save money. Get your copy from Heltzel Steel Form & Iron Co., Dept. PW, Warren, Ohio.

How to Solve the Brush Disposal Problem

277. Fitchburg Chippers, engineered to solve the brush disposal problem, reduce troublesome brush and trimmings to tiny, easy-to-dispose-of chips. Several models are available to meet your needs. May be mounted on truck body or on trailer, tractor or jeep. Full details in interesting, profusely illustrated 16-page bulletin. Write Fitchburg Engineering Corp., Fitchburg, Mass., or check the coupon for your copy.

Better Highways Through Salt-Soil Stabilization

162. Practical information for the men who build, repair and maintain our highways is provided in two bulletins issued by the International Salt Co., Inc., Scranton, Pa. General principles of salt-soil stabilization, applications, plant mix and road mix are described. Check the coupon for your copies.

Trenching Equipment Data Conveniently Assembled

212. The entire line of Cleveland trenching and backfilling equipment is now covered in a single bulletin, with material arranged for quick comparison of capacities, specifications and dimensions of all models. Twenty-four action photos graphically illustrates various job applications. Get Bulletin S-120 now for easy review of your trenching equipment needs. Just check the coupon or write to the Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio.

Levels Sidewalks and Curbs Quickly and Easily

29. How the Mud-Jack Method for raising concrete curb, gutter, walks and streets solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities—a bulletin by Koehring Company, 3026 W. Concordia Ave., Milwaukee 16, Wis. Check the coupon.

Get Data Now on This Catch Basin Cleaner

198. Simple powerful pneumatic bucket is featured by Netco Catch Basin Cleaner. Folder 33A gives details and illustrates operation of complete self powered truck mounted unit. Netco Div., Clarke-Wilcox Co., 118 Western Ave., Boston 34, Mass.

What You Should Know About Soil Sampling

255. Acker Soil Sampling Catalog No. 25 contains a complete and thorough collection of information about soil sampling in all types of sub-surface conditions. Modern sampling techniques are discussed together with recommendations as to tools and accessories. Write Acker Drill Co., Inc., Scranton, Pa., or check the coupon.

Give Full Protection To Treated Poles and Timbers

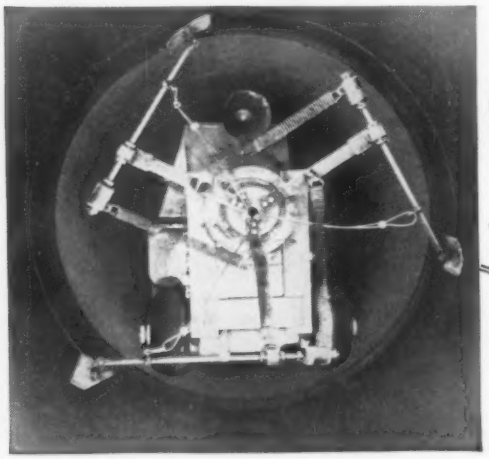
267. Bolt holes in treated poles and timbers used for guard rails and structures can easily be the first point of decay. Now you can assure maximum life by using the Greenlee Bolt Hole Treater, a simple device that forces preservative into the wood cells. Bulletin 13-15 gives the details. Greenlee Bros. & Co., Rockford, Ill.

Two-Way Radio Equipment For All Departments

363. The benefits of two-way radio communication in the uncongested non-interference 450-megacycle range make full information on this subject important to all engineers. Get full data on trouble-free systems from Motorola, Inc., Dept. PW, 4545 Augusta Blvd., Chicago 51, Ill. Just check the coupon.

Economical Scraper Handles Many Heavy Jobs

398. Among the many applications of the versatile Model D Tournapull are: grading and building roads; handling garbage disposal; and grading, leveling and terracing. For details on how its speed, power and ability to work either as a self-loading tool can help your production and lower your costs, write Le Tourneau-Westinghouse Co., Peoria, Ill., or check the coupon.



CENTRILINE goes to CUBA

The Centriline process has been selected by Municipio de la Habana to play an integral part in the expansion of this city's water supply system. Over 114,000 feet of new welded steel pipe, ranging in diameters from 30" to 78", will be cement-mortar lined in the near future.

In this process, the novel machine illustrated above is drawn through the pipe while cement-mortar is centrifugally sprayed on the pipe walls and troweled smooth by the rotating arms. Mortar thickness is controlled by the speed of the entire machine. Because the pipes remain in place throughout the process, traffic interruption is cut to a minimum; time and money are saved.

Whether you're expanding or rejuvenating your water system, follow the lead of progressive city officials and engineers around the world. Call on Centriline to add years of new life to your water supply lines.

Supervising engineer on the project is Francisco Pividal, C. E.; Chief Engineer is Adrian Macia, C. E.; General Contractor: Comp. Constructora M. A. Gonzales del Valle, S. A.; Pipe Contractor & Manufacturer: Tuberia de Concreto Universal, S. A.

CENTRILINE CORPORATION

A subsidiary of the Raymond Concrete Pile Company

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Branch Offices in Principal Cities of the United States and Latin America

• CEMENT-MORTAR LINING OF PIPES IN PLACE •

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay underdrain blocks conforming to ASTM standards, suggestions for layout and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute, c/o Editor, Public Works, 310 E. 45th St., New York 17, N. Y. Check the coupon and we will forward your request.

Complete Sanitation and Process Equipment Bulletin

40. A complete illustrated bulletin gives detailed information on all "Rex" sanitation and process equipment. 36 pages of engineering data, process description, conversion factors. Get Bulletin 51-83 by checking the coupon Chain Belt Co., Box 2022, Milwaukee 1, Wis.

High Rate Filters For Sewage Treatment

74. Accelerated biological oxidation in treatment of sewage and other organic wastes is a feature of Infilco's Accelo Filter system. Bulletin 6200 explains the direct recirculation principle, shows plant layouts, and gives performance data. For your copy write Infilco Inc., Box 5033, Tucson, Ariz., or check handy coupon.

HERE'S PROOF THAT A-W GRADERS WITH ALL-WHEEL DRIVE HAVE 30% MORE POWER AT THE BLADE

To calculate Power-at-the-Blade, it is necessary to determine (1) skid pull due to traction and (2) maximum rim pull due to engine; using the formulas at the right, which are those used by manufacturers of tires and farm tractors.

The *effective* Power-at-the-Blade will be the *lesser* of the two figures. If you have more power than is necessary, and insufficient weight on driving wheels, you will slip the wheels, making SKID PULL the *limiting factor.* If you have insufficient power to slip the wheels, RIM PULL due to engine will be the *limiting factor.*

SKID PULL
(DUE TO TRACTION)

SKID PULL = W x f

W = WEIGHT ON DRIVERS
f = FRICTION COEFFICIENT BETWEEN TIRES AND GROUND

MAXIMUM RIM PULL
(DUE TO ENGINE)

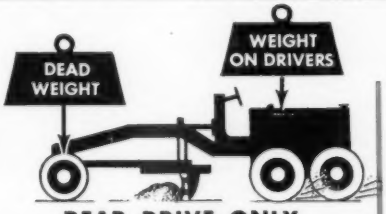
$$\text{RIM PULL} = \frac{T \times 12 \times R}{Y}$$

T = ENGINE TORQUE AT PEAK (INTERMITTENT RATING)
R = TOTAL RATIO, ENGINE TO REAR WHEELS
Y = LOADED RADIUS OF TIRE (INCHES)

EFFECTIVE POWER AT THE BLADE WILL BE THE LESSER OF THE ABOVE TWO FIGURES

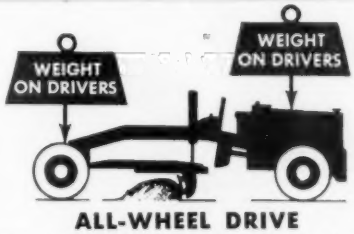
Working in average dirt in first or second gear, all graders have more than enough weight to spin their drivers; therefore Skid Pull is the limiting factor, and the measure of comparative performance. The Austin-Western Power Grader, with its exclusive All-Wheel Drive, has 30 per cent more weight on driving wheels than any other grader; consequently moves 30 per cent more material . . . it's as simple and inescapable as that.

HERE'S WHY A-W GRADERS DELIVER MAXIMUM POWER



REAR DRIVE ONLY

No grader with a dead front end can possibly deliver maximum power at the blade. Weight carried on the idling front wheels of the conventional tandem-drive grader is *dead* weight, contributing nothing to traction—*lazy* weight, consuming power to no purpose. Every pound of weight not carried on a driving wheel *handicaps your horsepower.*



ALL-WHEEL DRIVE

On the Austin-Western Power Grader there are no idling front wheels—no dead front end to consume power and decrease efficiency. Every pound of weight rides on a driving wheel. Every pound is working weight—contributing 100 per cent to traction, utilizing the torque of the engine to best advantage, delivering maximum power where it counts—*at the blade.*

Austin-Western
Power Graders · Motor Sweepers
Road Rollers · Hydraulic Cranes

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Construction Equipment Division

Manufactured by
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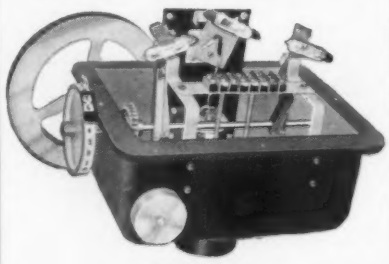
ROTO-TROL



RF-2
with ALTO-TROL

Puts that second pump to work.

A 2-pump RF-2 ROTO-TROL with a built-in ALTO-TROL will operate each pump on alternate starting cycles, assuring equal use and wear of both pumps. Operates both pumps when required. FLOAT-CONTROLLED. Depth Indication optional — extra.

Write for full data.

Water Level Controls Division

HEALY-RUFF Company

791 Hampden Ave., St. Paul 4, Minn.

Design Data Offered On The Spiragester

42. The Spiragester, a unit which combines the Spiraflo Clarifier and a digestion compartment in a two-level arrangement to save space and reduce construction costs, is fully described in Bulletin 124 released by Lakeside Engineering Corp., 222 West Adams, Chicago, Ill. Design details, including capacities for 8' to 24' units are furnished together with typical plan and elevation. Check the coupon for this helpful bulletin.

A Handbook of Sewer Cleaning Methods and Materials

44. Complete, easy-to-follow directions for every type of sewer cleaning operations and the equipment needed for effective cleaning work is covered in a 40-page booklet issued by Flexible Sales Corp., 3786 Durango, Los Angeles 34, Calif. Full details are provided on power cleaning machines, the SeweRodeR, hand tools and all accessories. Water main and culvert cleaning methods are included. Check the coupon for your copy of this helpful handbook.

Helpful Design Data For Sewage Ejectors

81. The application and advantages of pneumatic sewage ejectors are outlined in a new bulletin of the Blackburn Smith Mfg. Co., Inc., Hoboken, N. J. Included are piping diagrams for electrode and float switch controls plus dimensions and layouts for single and duplex systems. Get your copy by checking coupon.

Useful Data on Butterfly Valves

100. Complete descriptions and tables of dimensions on the full line of Rockwell Butterfly Valves are contained in several bulletins published by the company. Construction details and special control features are illustrated. Write W. S. Rockwell Co., Eliot Street, Fairfield Conn.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy. Get yours by checking the coupon.

Reference Book on Lubricated Plug Valves

273. Lubricated plug valves, including stick-proof lever sealed valves for easy operation and positive mechanical seal are fully described in reference books issued by Homestead Valve Mfg. Co., Box 550, Coraopolis, Pa. Check the coupon for your copy.

Blower Selection Data Aids Sewage Plant Design

274. Characteristic curves for blower operation with constant-speed, multi-speed and variable speed motors; details of several types of blowers; data on accessories; and a discussion of advantages of positive displacement rotary blowers are provided in Bulletin RB-154 of Roots-Connersville Blower Div., Connersville, Ind. Get this helpful bulletin by checking the coupon.

Get the Facts on The Contact Aeration Process

303. Full engineering details on the submerged contact aeration process of sewage treatment, including diagrams of plant units, area requirements, operating costs and other details are available in a bulletin of the Hays Process Co., Box 768, Waco, Texas. Check the coupon to get the facts.

Valuable Booklet on Porous Diffuser Plates and Tubes

341. A helpful 16-page booklet published by the Norton Co. is a complete guide for the selection of porous media for installation in rapid sand filters and activated sludge plants. Full data are provided for the consulting engineer. Maintenance of porous media is also discussed at some length. Get Form 140 from Norton Co., Worcester 6, Mass. by checking the coupon.

CONSTRUCTION EQUIPMENT AND MATERIALS

1,001 Profitable Uses For Holmes-Owen Loader

39. The addition of a Holmes-Owen Loader to your dump truck converts it into a complete digging and loading unit that enables one man to load, haul and dump. Illustrated folder shows how this self-loading unit with hydraulic crowding action can be a real time and labor saver for the municipality or contractor. Check the handy coupon for full data. Ernest Holmes Co., Chattanooga, Tenn.

What You Should Know About Air-Placed Concrete

67. For a detailed explanation of the principle of "gunned" or "air placed" concrete and description of the improved Model 750 and 1250 Bondactors, be sure to get your copy of Form 553 from Air Placement Equipment Co., 1011 W. 24th St., Kansas City 8, Mo. Check the coupon today.

For Fast, Smooth Pipe Cuts

68. Descriptive literature on the Reed 4-wheel hinged pipe cutter which operates in close quarters, gives quick, easy right-angle cuts, is available from Reed Mfg. Co., Erie, Pa. Check the coupon.

Inexpensive Ditcher Handles Heavy Digging

91. The Shawnee Scout Ditcher, a new heavier model for extensive digging has been added to the Shawnee line of ditchers and dozers. All models are designed to handle ditching and backfilling operations quickly, efficiently and at low cost. Full information on this equipment will be sent by Shawnee Mfg. Co., 1947 N. Topeka, Topeka, Kansas. Just check the coupon.

Grading Can Be Faster, Cheaper and Easier

96. You'll like every feature of the Austin-Western 99H Grader. It has all-wheel drive, all-wheel steer, controlled traction, precision sideshift and a high lift, extreme reach, reversible blade. Get data from Austin-Western Co., Aurora, Ill.

Handbook of Castings For All Public Works Construction

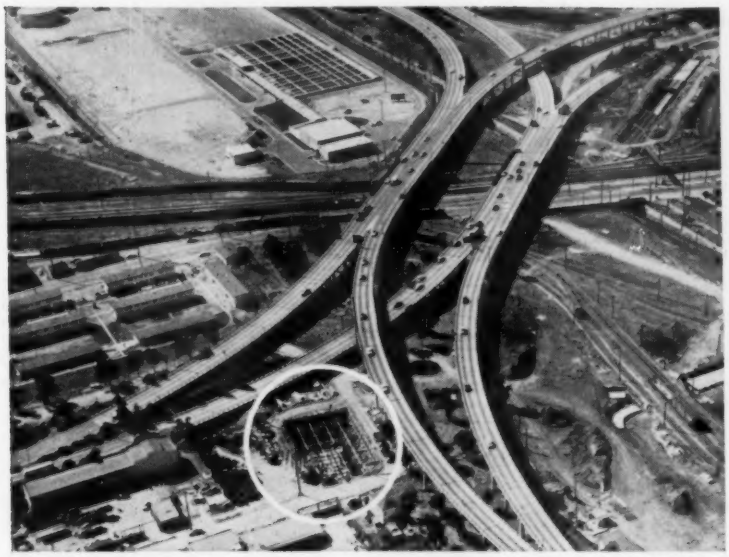
220. Every type of construction casting needed by engineers and contractors in the public works field will be found in a 136-page catalog issued by Neenah Foundry Co., Neenah Wis. Detailed illustrations and complete tables of dimensions will help the designer and materials buyer. Get your copy of this valuable catalog by checking the coupon today.

Complete Protection Of Iron and Steel Products

242. What are the advantages of Hot-Dip Galvanizing? Why does it offer complete protection at such an economical cost? You'll find the answers in the attractive booklet "Stop Rust", which gives you the full story of the process plus a comprehensive coating comparison chart. Get your copy promptly by checking the coupon or write American Hot-Dip Galvanizers Assn., Inc., 1st National Bank Bldg., Pittsburgh 22, Pa.

Faster Cuts in Concrete Pavement

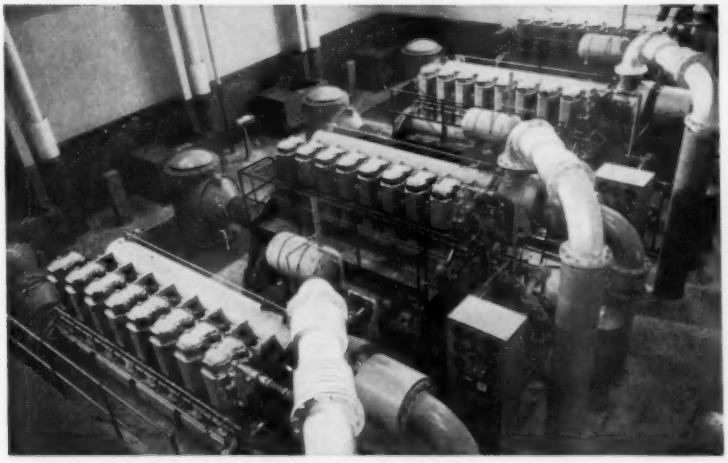
317. Clean, fast cuts in green or cured concrete and asphalt pavements are easily made with the powerful Champion concrete saw. Perfect balance and "either-side" blade arrangement helps speed the work when sawing joints and cutting outlines for patches. Get full details from Champion Mfg. Co., 2028 Washington Ave., St. Louis 3, Mo. Just check the coupon.



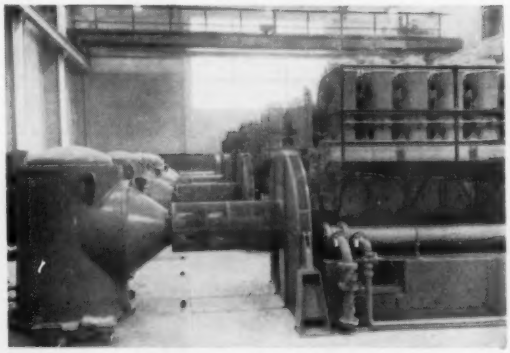
The Oakland storm water pumping station is equipped with four Enterprise Turbocharged Diesels driving huge mixed-flow pumps. Drainage conduits are large enough to drive an auto through.

Early construction stage of new pumping station, heart of the East Bay city's lowland drainage and flood control project.

Let it pour! Oakland licks storm flood problem with new diesel pumping plant



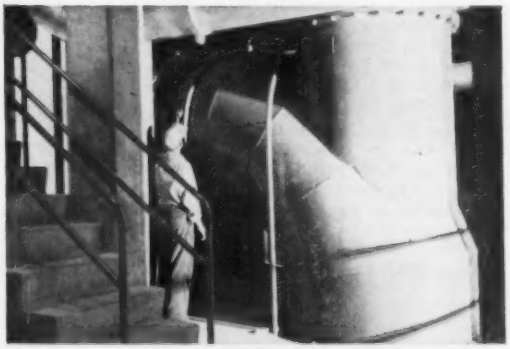
The four 1200 BHP Enterprise DSG-318 Engines are completely automatic, require no attendant. Rising water level starts engines, regulates speeds for proper pumping capacity.



Eight-cylinder engines drive giant axial flow pumps though flexible couplings and right angle gears.

Will your city be faced with flooded streets and costly water damage this year? Your flood problem can be prevented by calling in qualified Enterprise engineers now to assist you in planning adequate, independently powered flood control facilities. No matter what pumping capacities you require, there's an Enterprise Engine designed to do the job more efficiently and at lower cost.

Enterprise Engines for every municipal need. Whether it's for flood or water supply pumping systems, stationary or portable electric generating plants, or for sewage disposal, you'll find there's an Enterprise Engine ideally suited for most dependable service. Contact the Enterprise Engine sales office in your area, or write us direct about your problem.



650 million gallons of storm water can be pumped through this Enterprise equipped station in 24 hours—a full railroad tank car every second!

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Streamlined Data on Tractors, Scrapers and Power Units

102. The complete line of International Industrial Power products, 73 in all, is described in a new 48-page catalog just published by International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. Technical data has been streamlined, yet provides abundant descriptive material on each piece of equipment. Check the coupon for the latest on crawler and wheel tractors, scrapers, dozers and related attachments plus International Diesel, gasoline and gas power units.

Portable Hot Asphalt Paving Repair Unit

250. Maximum economy in paving repair and maintenance is claimed for the compact "Patchmobile" which has a rotary tube continuous dryer, batching hopper for accurate proportioning, twin hot asphalt tanks, heat jacketed pugmill, tool heaters and hand spray bar. Get latest data from Wylie Mfg. Co., 5926 N. W. 39th St., Oklahoma City 12, Okla. Use the coupon.

Latest Data on Standards For Traffic Control Signals

258. All-aluminum standards and brackets for mounting traffic signals over roadways and pedestal-type bases for signals mounted on the curb are described in a bulletin of Pfaff & Kendall, 84 Foundry St., Newark 5, N. J. Check the advantages of these maintenance-free units when planning new installations and replacements. Use the coupon to get latest data.

Heavy Duty Compressor Designed for Smaller Jobs

295. A new four-page bulletin illustrates and describes many exclusive Le Roi features found on the 85 cfm Airmaster. Engine and compressor are of one-unit design and provide construction features rarely found in the smaller compressors. Ease of operation, maintenance and mobility allows the 85 to do more hard, heavy-duty work. To get full data write to Le Roi Div., Westinghouse Air Brake Company, Milwaukee 14, Wis., or check the coupon.

8 Reasons Why You Should Check the Jaeger Loader

207. In a profusely illustrated 16-page catalog devoted to the applications and special design features of the Jaeger "Load-Plus" tractor-loader unit, eight good reasons listed to back up the claim that this machine outproduces any other loader of its size. These include load capacity, balance, reach, maneuverability, automatic power adjustment by torque converter, instant reversal, multiple speed and ease of control. Check them all by getting a copy of Catalog L100-3. Check the coupon today. Jaeger Machine Co., 400 Dublin Ave., Columbus 15, Ohio.

Versatile Road Wideners Improve Highways at Low Cost

374. In illustrated bulletins describing Apsco road wideners and base pavers you will find full data on two versatile pieces of road-building equipment that will help you hold down costs while bringing old roads up to present day standards. Get the full story today by checking the coupon or write to Blaw-Knox Equipment Div., Blaw-Knox Co., Pittsburgh 38, Pa.

Restoration and Protection Of Concrete Structures

385. A "How to Do It" bulletin describing the Thoro System for repair and sealing interior and exterior masonry surfaces is available from Standard Dry Wall Products, Inc., New Eagle, Pa. The treatment for every water problem is presented in illustrated case histories in this useful publication. Check the coupon for your copy.

Automatic Cutter Saws Cast Iron Pipe

393. This portable automatic pipe saw, available with either pneumatic or electric drive, makes fast precision cuts in 8-in. to 60-in. cast iron or steel pipe. Features are light weight, minimum clearance required, easy operation even when submerged. Get details from Prescott Tool Co., Inc., Worcester, Mass., by checking the coupon.

STREET LIGHTING AND TRAFFIC CONTROL

Get Full Data On the Radar Speed Meter

22. Accurate readings of vehicle speeds, with direct indications in miles per hour and a graphic recorder for permanent record are available by use of the Electro-Matic Radar speed meter, a product of Automatic Signal Division, Eastern Industries Inc., Norwalk, Conn. For full data on this device, just check the coupon.

Investigate These Street Lighting Standards

54. You can get complete data on Kerrigan factory-built "Weldforged" street lighting standards, brackets and mast arms by using the handy coupon. Check these strong, well designed, inexpensive steel standards for practical street and highway lighting. Handsome 26-page folder includes data sheets on floodlighting and area lighting applications. Kerrigan Iron Works, 1033 Herman St., Nashville, Tenn.

Investigate Photoelectric Controls For Your Street Lights

365. "Lumatrol" photoelectric switches provide fully automatic control for street light and flood light installations. Special plexiglass cover senses light from all directions, adds accuracy. Simple construction gives reliable operation, easy installation and compact unit. For full details get form 111 from Micro-Balancing, Inc., 191 Herricks Rd., Garden City Park, N. Y. Check the coupon today.

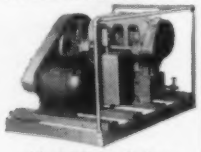
SAVE TIME, MONEY, LABOR WITH THESE STURDY PUMPS

Enclosed unit. All working parts are readily accessible.

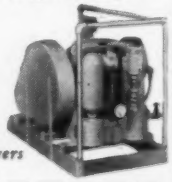
● Just turn the high pressure hose on that heavy equipment for a quick clean-up. The solid, hard, driving, high pressure stream from a Hardie Powered Pump Unit will strip off the caked mud, grease, dirt—even that "behind the ears"—in a matter of seconds.

● The Hardie Spray Gun is readily adjustable by a pressure of the fingers from solid stream to a high pressure spray for over-all washing, or a fog like mist for fragile things and fog fire fighting.

● Hardie builds powered pump units in many sizes and models. Enclosed units from 5 gpm at 300 psi to 24 gpm at 400 psi. On casters or skid mounted units up to 60 gpm at 800 psi. Handle all liquids, chemicals, semi-liquid materials. All Hardie pumps are trouble-free, rugged, vertical piston-type pumps that work to their ratings smoothly, quietly, at slow speed.



Model LC—Delivers 50 gpm at 800 psi.



Model XCVA—Delivers 18 gpm at 600 psi.

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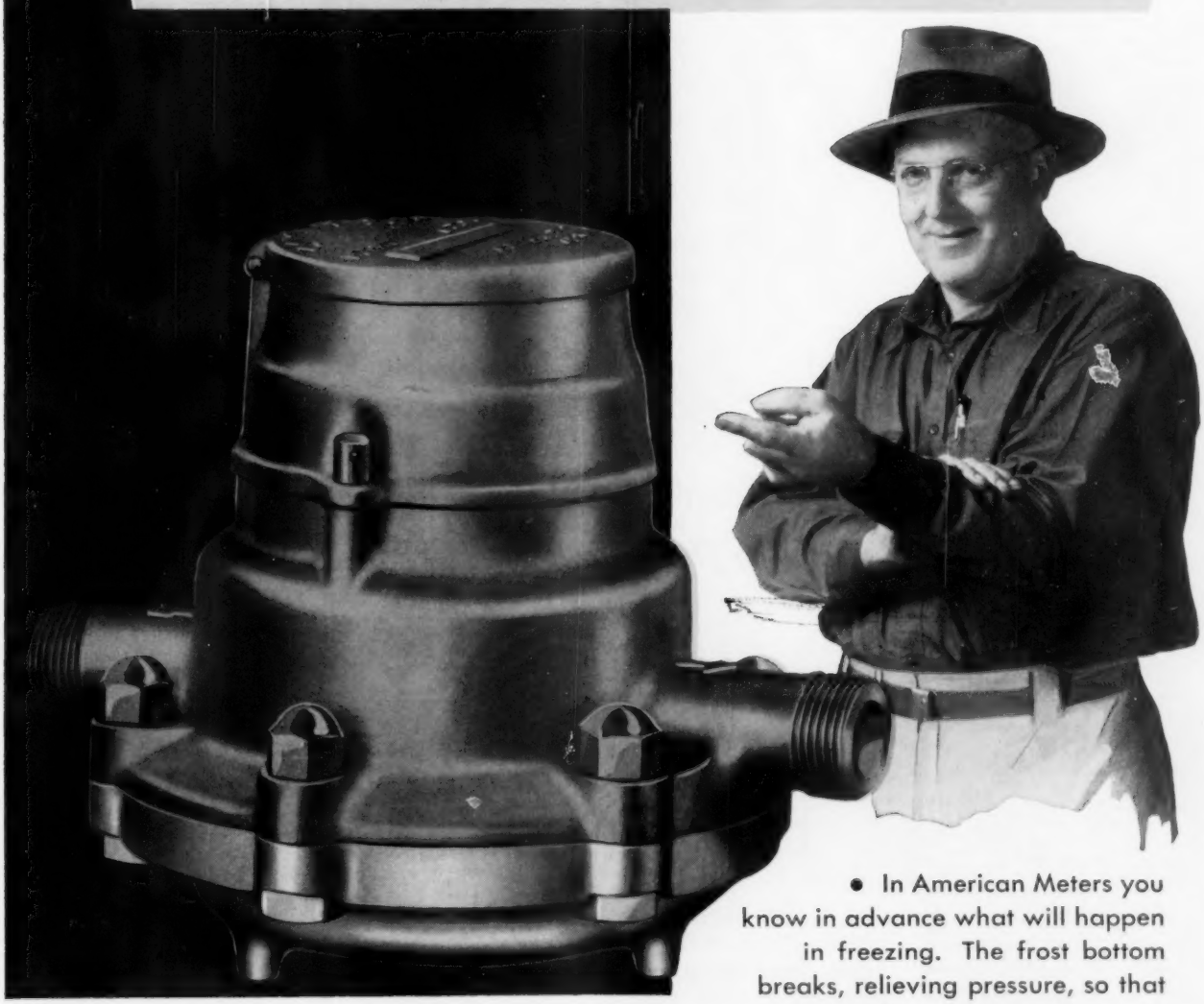

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BUFFALO METER CO.

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Now's the time to mail this month's Readers' Service card.

Be Sure to Investigate These Parking Meter Features

146. Parking meters designed for greater public convenience, unlimited flexibility with easy adjustment of time limit rate and coin acceptance plus simplified enforcement inspection are described in the attractive bulletin of Magee-Hale Park-O-Meter Co., Commerce Exchange Bldg., Oklahoma City 2, Okla. Get all details on the Model H meter by checking the coupon.

How Reflective Sheeting Improves Traffic Signs

157. Get full data on Groteline reflective sheeting for smooth, brilliant, long-life traffic signs and marking devices from the Grote Mfg. Co., Bellevue, Ky. Use the handy card or coupon today.

Helpful Data on Street Lighting Equipment

193. Complete data on Monotube street lighting lighting standards together with information on brackets, mast arms and accessory attachments is available from Union Metal Mfg. Co., Canton 5, Ohio. Be sure you have the latest data on street and highway lighting equipment. Check the coupon now.

Street Lighting Application Curve Eliminates Calculations

257. An easy-to-use chart from which illumination level, spacing and proper mounting height can be determined has been prepared by the Illuminating Engineering Laboratory, General Electric Co., West Lynn 3, Mass. For a copy of the chart and instructions on its use check the handy coupon.

A Guide to Effective Traffic Safety

300 A 20-year catalog with hundreds of illustrations of all types of signs used on highways and in motor and pedestrian traffic areas is offered to public works officials by Traffic and Street Sign Co., 84 Foundry St., Newark 5, N.J. This convenient reference covers all your sign needs. For your copy check the coupon today.

RECREATION

Helpful Reference on Swimming Pool Equipment

53. A complete reference catalog of swimming pool supplies chemicals and equipment is available from Modern Swimming Pool Co., Inc., 1 Holland Ave., Dept. PW, White Plains, N. Y. Detailed information covers filters and accessories, all types of fittings and equipment and helpful suggestions on chemical treatment and pool maintenance. Get your copy of this 44-page book by checking the coupon.

Need Data on Swimming Pool Equipment?

180. Every type of swimming pool equipment—boards, ladders, slides, safety equipment and related accessories—fully described and illustrated in attractive folder issued by American Playground Device Co., Anderson, Ind. All units feature modern design and superior construction to give lifetime service. Check the coupon for this attractive folder.

WEED CONTROL

Weed Killing Case Histories

205. Weed and grass control lasts longer . . . costs less with Du Pont "Telvar" weed killers. Interesting folder published by Grasselli Chemicals Dept., E. I. Du Pont de Nemours & Co., Inc., Wilmington 98, Del. Full color photographs demonstrate effective action; text shows application methods for best results. Check the coupon for your copy.

Powerful Mist Sprayer Controls Pests

241. Mist sprayers for shade tree and mosquito control, roadside weed control sprayers and a full line of pressure pumps, engine equipment and spray guns in assemblies for every spraying need are presented in an illustrated catalog by Hardie Mfg. Co., Hudson, Mich. Get 40-page Catalog No. PC 57 for data on all types of chemical spray and dust equipment. Check the coupon.

How to Simplify Your Weed Spraying Operations

293. Chemical spraying for weed control is made simpler and easier by the Tarrant "Direct from the Drum" sprayer, a compact power spraying unit which will handle dozens of jobs. Get full data from Tarrant Mfg. Co., 27 Jumel St., Saratoga Springs, N. Y. Check the coupon.

Investigate "Tifa" For Insect Control

308. With "Tifa", the Todd Insecticidal Fog Applicator, chemicals are distributed as a true, clean fog. Use coupon for full data on public health programs. Combustion Equipment Div., Todd Shipyards Corp., 81-16 45th Ave., Elmhurst, N. Y.

CIVIL DEFENSE

Electric Power Wherever You Need It

75. Electric power for every job—for construction, maintenance and emergencies—is always available for the owner of a convenient Homelite carryable generator. These compact, gasoline engine operated units are made in a variety of sizes to suit every power requirement. Get full details by writing Homelite Corp., Port Chester, N. Y., or check the coupon.

Koehring 1/2-yard hoe

DIGS 17 3/4-FEET DEEP

31 IN. WIDE

With long, deep reach and 8'-9" dump clearance, Koehring ½-yard 205 hoe delivers big output on basements, footings, water and gas mains, storm sewers and other below-grade digging. Powerful cable crowd, fast line and swing speeds maintain big-yardage production. Heavy-duty box-section boom and dipper arm resist side-sway. Close-coupled dipper pulls up tight to boom, avoids spillage. This 205 converts to ½-yard shovel, ½ to ¾-yard clamshell or dragline, 10-ton crane. Also available on truck mounting (15-ton lift capacity).

Get complete facts. Send for Koehring 205 bulletin.

To: KOEHRING COMPANY, Milwaukee 16, Wisconsin

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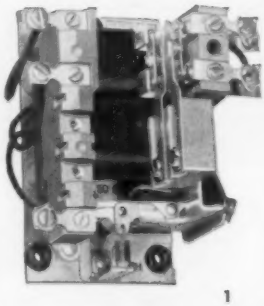
LIQUID LEVEL B W and INDUSTRIAL CONTROLS



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• Write for latest catalog covering the complete line of B/W Induction Relays, Relay Enclosures, Contactors and Starters, Multiple Pump Controls, Electrode Holders, Starter and Relay Combinations, Special Controls and Panels.

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It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

Do You Have An Independent Source of Electricity?

27. An independent source of electricity which will supply power for vital services when regular sources fail can be invaluable during emergencies. Check Kohler Bulletin KEP-31 which furnishes data that will help you select the plant best suited for your needs. Many models, 500 watt to 30 Kw, portable and stationary, are described. Write the Kohler Co., Kohler, Wis., or use the coupon.

Get the Facts on Air Raid Sirens

86. There's more to be considered in air raid warning sirens than the loudness of the signal. Get complete information on efficient size and spacing of sirens from Federal Sign and Signal Corp., 8733 So. State St., Chicago, Ill., by using coupon.

Does Your Water Works Have Standby Power?

224. Dependable Climax power plants are ready for emergency service to insure fire protection, and can also save power costs by peak load operation. Use the coupon for full data on Climax, 40 to 495 HP, operating on sewage or natural gas, butane or gasoline. Climax Engine & Pump Mfg. Co., So. La Salle St., Chicago 3, Ill.

Diesel Engines For Municipal Power Needs

359. Dependable power for water supply or flood control pumping stations, stationary or portable electric plants and many other municipal needs can be provided by engines described in literature of the Enterprise Engine & Machinery Co., 18th & Florida Sts., San Francisco 10, Calif. Get latest data by checking the coupon.

●

REFUSE COLLECTION AND DISPOSAL

Sanitary Landfill Operation and Methods

28. The location and area requirements for sanitary landfill, operation methods for trench type and area fills, equipment selection and costs are items discussed in an 8-page booklet issued by Allis-Chalmers Mfg. Co., Milwaukee 1, Wis. Be sure you have this reference when considering the problem of garbage and refuse disposal. Check the handy coupon today.

New Roto-Pac Features Speed Refuse Collection

50. Features of the Roto-Pac refuse collection unit, which include automatic continuous loading and packing, with increased power to provide for larger loads in the same size body, are described in bulletins issued by City Tank Corp., 53-09 97th Pl., Corona, L. I., N. Y. Check the coupon now to learn how your collection problems can be eased.

How New, Larger Load-Packer Cuts Refuse Collection Costs

51. Ever increasing problems in refuse collection work include longer hauls and higher costs of labor, chassis, operation and maintenance. As a solution, Gar Wood offers Load-Packers with dual-thrust compaction that gives big capacity on shorter wheelbase, plus safe, labor-saving operation. Profusely illustrated Form W-144 tells why you should investigate Load-Packers. Check coupon or write Gar Wood Industries, Inc., Wayne, Mich.

Efficient Landfill Operations For Small Communities

349. Step-by-step photos and concise text are used in a bulletin of the Oliver Corp., to show the construction and operation of a sanitary landfill, using equipment especially suitable for the smaller community, the Oliver OC-3 Tractor-Loader. Besides providing economical refuse disposal, many other jobs handled by this unit are suggested. For a copy, write to the Oliver Corp., 400 W. Madison St., Chicago 6, Ill. or check the coupon.

Increasing the Efficiency of Bulk Rubbish Collection

177. Strategically spotted bulk containers can be handled by one man operating a Dempster-Dumpster equipped truck. Get full details of this cost-saving system of rubbish collection, as used by many cities to increase efficiency and eliminate unsanitary conditions. Write Dempster Brothers, Inc., 952 Dempster Bldg., Knoxville 17, Tenn., or use the handy coupon.

What You Should Know About Refuse Incinerators

362. Two helpful bulletins tell what you should know about low cost refuse incineration for the small community and for larger cities. Your questions on mechanical stoking, burning rates and operating problems are discussed. Get Bulletins 217 and 223 from Nichols Engineering & Research Corp., 70 Pine St., New York 5, N. Y. Just check the coupon.

How to Construct A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 8, Wis. Get your copy by checking the coupon; you'll find this booklet both interesting and valuable.

Check These New Features On Refuse Collection Bodies

383. The all-new Heil "Collectomatic" refuse collection unit incorporates the best features suggested by municipal operating crews, supervisors and private operators to provide easy loading, simple operating mechanism, bulldozer type packing, fast dumping and many other important advantages. Check them all by getting attractive Bulletin BH-54103 from The Heil Co., 3044 W. Montana St., Milwaukee 1, Wis. Your copy is ready—just check the coupon.

foul **MALODORS** from MUNICIPAL GARBAGE DUMPS can be effectively masked with ALAMASK® industrial reodorants.

THESE obnoxious odors, caused by the degradation of proteins, amines and sulfur compounds, contribute to extensive and annoying air pollution. This can be alleviated by the spraying of ALAMASK or a combination of ALAMASK reodorants.

ALAMASK has also been found very effective in abating the malodors of garbage trucks and the ash discharge from Municipal incinerators.

RHODIA'S experienced engineers will be glad to work with you on your garbage dump odor problems. Your community will thank you if you send today for our technical literature or the services of our engineering section. ALAMASK sample will be supplied upon receipt of request on a business letterhead.

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But the greatest savings come in lower maintenance costs, resulting from resistance to corrosion. When vandalism or accidental damage punctures the message film of a steel sign, only prompt and costly repairs can halt progressive rusting that destroys legibility and soon reduces the sign to scrap. But corrosion-resistant Alcoa Aluminum signs stay on the job no matter how long repairs are postponed.

In 21 states besides those we've named, and in scores of cities and counties, aluminum's capacity for cutting costs has made it a standard sign material. Your Alcoa Distributor can help you save as they do. He stocks aluminum sign blanks in a wide range of standard shapes and sizes. He can furnish aluminum sheet if you shear your own blanks. And he carries a complete line of Alcoa Aluminum Fasteners for trouble-free installations. If you require special counsel on fabrication or finishing, whether for painted, enameled or reflectorized signs, your local Alcoa sales engineer is as easy to reach as your telephone. ALUMINUM COMPANY OF AMERICA, 1978-D Alcoa Building, Pittsburgh 19, Pa.

Specifications for Alcoa standard sign blanks

Thickness	Width (Hor.)	Length (Vert.)	wt/pc	Thickness	Size	wt/pc
.064" x	12" x	18"	1.34#	.064 x 18"	Octagon	1.72#
.081" x	18" x	24"	3.40	.081 x 24"	Octagon	3.75
.081" x	24" x	30"	5.66	.081 x 30"	Octagon	5.85
.081" x	36" x	12"	3.43	.081 x 24" x 24"	Diamond	4.57
.081" x	30" dia. x		5.57	.081 x 30" x 30"	Diamond	7.08

All blanks fabricated from Alloy 6061-T6 flat sheet with two ⅜" mounting holes. All sizes except octagon have rounded corners with ½" radius. Alodized finish applied after blanking and punching insures full coverage. Packaged 10 per carton.

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ALCOA ALUMINUM
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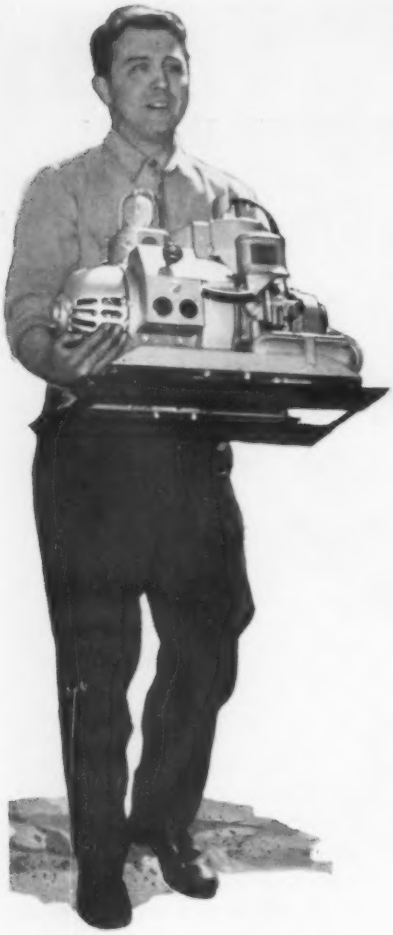


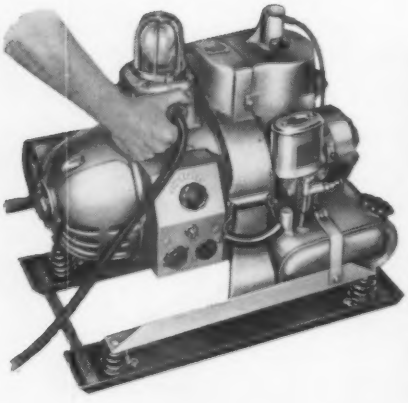
HANDY UTILITY

for Public Works

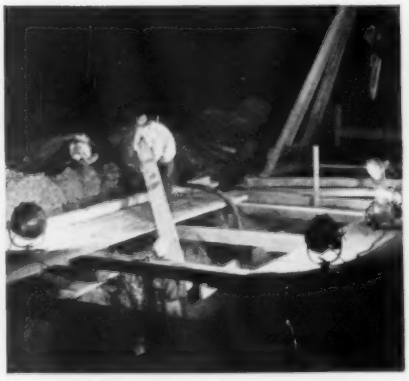
Day and night, there's always a job for a Homelite. You use it for floodlights. You use it for power tools. You use it for standby emergency power. Yes and you use it anyplace . . . *everyplace.*

Small and compact, a Homelite stows away neatly in your truck. Light in weight, one man can pick it up and put it in operation quickly. And famous for its dependability, a Homelite gives you quick-starting and continuous trouble-free performance in all kinds of weather . . . hot, cold or wet.

Write for a free demonstration.



During power failures due to storms or accidents, simply plug into a Homelite, for emergency power requirements.



On night repairs, brilliant floodlights operated by Homelite Generators speed work, save time, save money.

On day repairs, electric power tools operated by Homelite Generators speed work, save time, save money.

Manufacturers of Homelite
Carryable Pumps • Generators
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PERFORMANCE · DEPENDABILITY · SERVICE

HOMELITE CORPORATION

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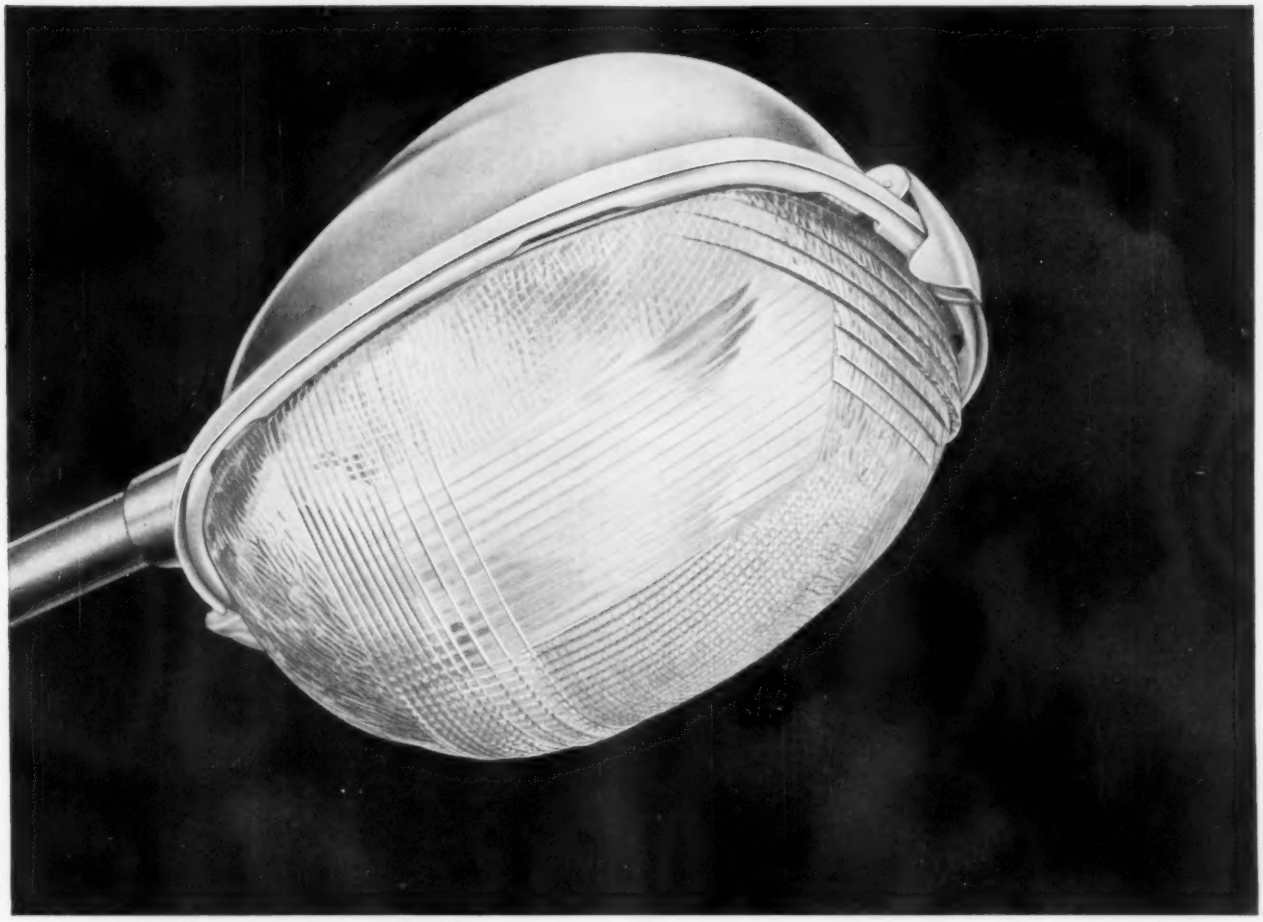
Canadian Distributors: Terry Machinery Co., Ltd., Toronto, Montreal, Vancouver, Ottawa.

Now's the time to mail this month's Readers' Service card.



GENERAL ELECTRIC ANNOUNCES . . .

New FORM 400 Luminaire

General Electric's new Form 400 luminaire represents a major advancement in mercury street lighting. Its attractive, functional design makes the luminaire flexible and easy to service.

BETTER OVER-ALL VISIBILITY results from a unique optical design. Distribution patterns I.E.S. Types II and III are available, assuring high utilization and uniform pavement brightness regardless of street width.

EASY TO SERVICE, the Form 400 luminaire reduces maintenance costs. Hinged glassware speeds up maintenance, and no tools are required to detach either the reflector or glassware from the unit.

GREATER FLEXIBILITY is obtained with a choice of five different mercury lamps. In addition, the Form 400 can operate on conventional circuits with ballasts, or in series on the new Ballastless Mercury circuit.

MORE INFORMATION on this outstanding new development in mercury street lighting is available from your nearest G-E Apparatus Sales Office, or Authorized Agent, or by writing Section 452-155, Outdoor Lighting Dept., General Electric Co., West Lynn 3, Mass.

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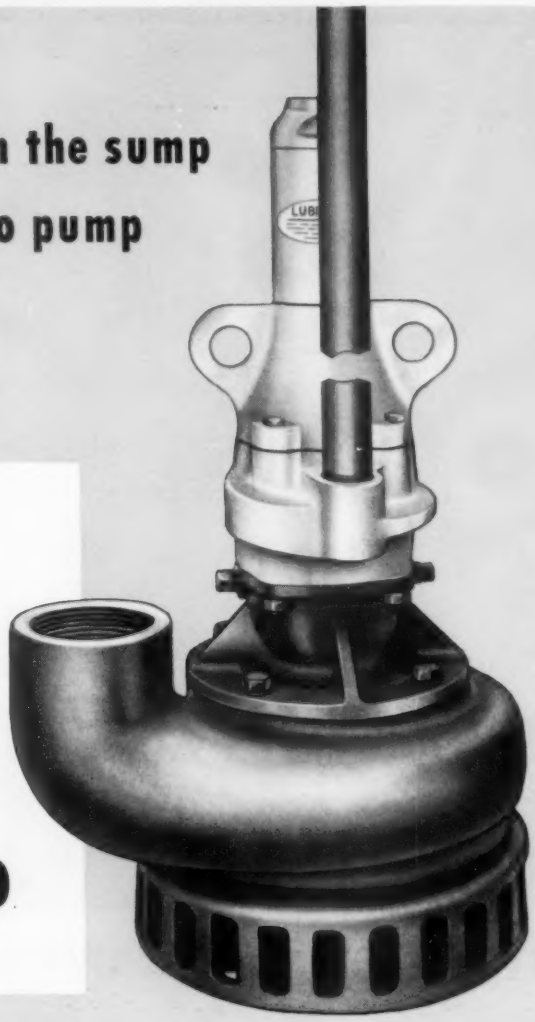
Just drop in the sump
It's ready to pump



BJ
Pneumatic Sponge Pump

A lightweight, portable sump pump that needs no priming

Built for heavy-duty use where sand and abrasives are found, such as mine shafts, winzes, cofferdams, caissons, sumps, cisterns, pits, tanks, ditches, basements, manholes, bilges, construction projects.

This BJ Pneumatic Sponge Pump is a self-contained, air-powered pump—ready to go to work for you simply by hooking it up to any 105 or 125 c.f.m. air compressor. No priming is needed. Just connect air hose and water discharge hose. An exhaust pipe prevents muck and water from entering the motor and the length of this exhaust can be extended as required. The pump provides capacities up to 380 gpm and operates against heads up to 76 feet.

Write for BJ Bulletin No. 543-3-900 or contact your nearest Byron Jackson Pump sales office.

SPECIFICATIONS	
Overall length	20"
Maximum width	12"
Size of discharge nozzle	2½" Pipe Tap
Size of discharge hose recommended	2½"
Size solids which runner will pass	¾"
Net weight	55 lbs.

You'll do better with BJ

Byron Jackson Co.

Since 1872

PUMP DIVISION
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LOS ANGELES 54, CALIFORNIA

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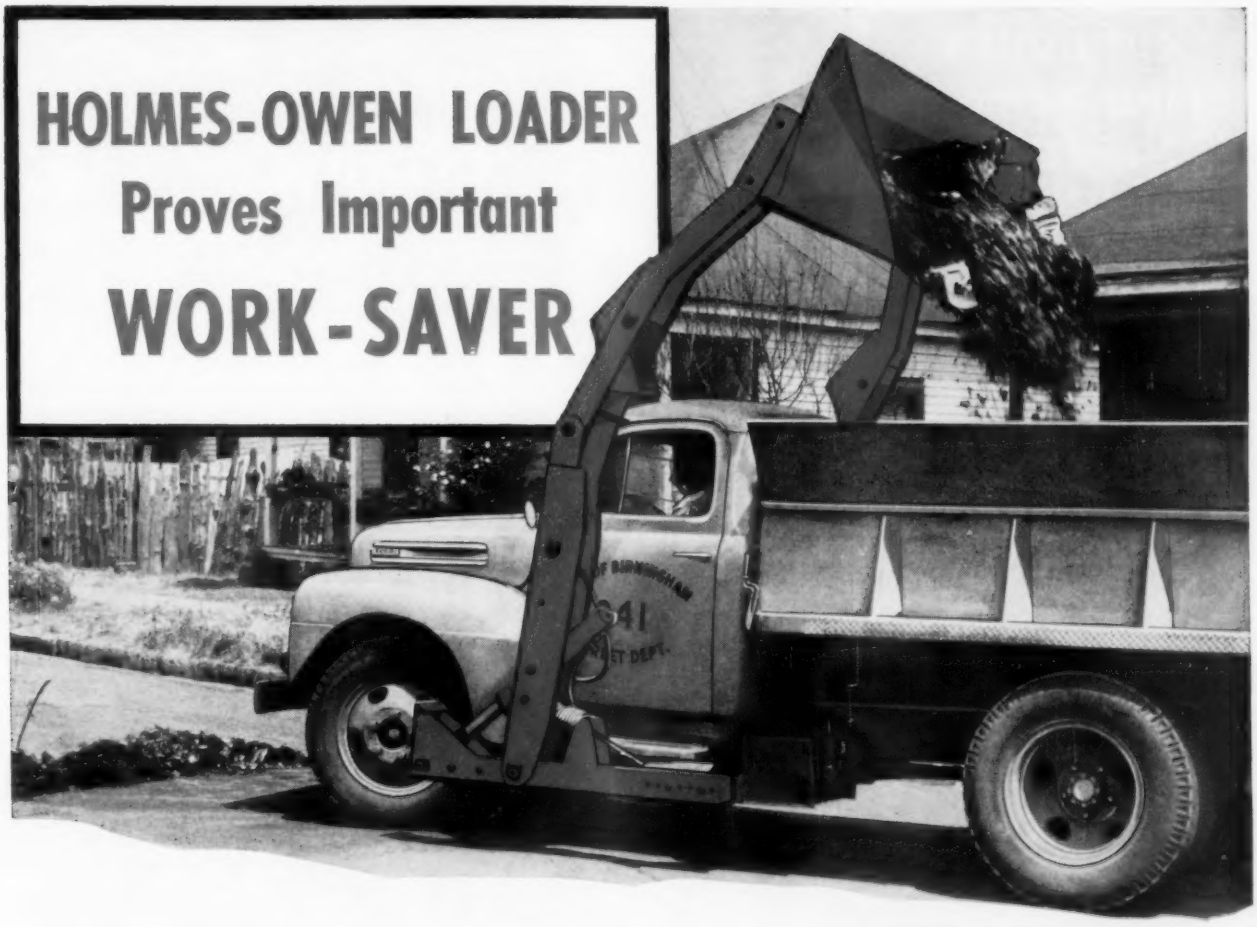
HOLMES-OWEN LOADER Proves Important WORK-SAVER



Provides BIG SAVINGS For These CITIES

MORE AND MORE key cities are cutting operating costs the modern, *mechanical* way — through the use of dump trucks equipped with HOLMES-OWEN Loaders. For example, in the maintenance of streets, parks, airports and other public properties, the cost of many loading and cleaning up operations has been reduced as much as 50 per cent.

COLLECTING trash, leaves and broken pavement, handling sand, dirt, ashes and snow — these are a typical few of the many jobs that can be done faster and at lower cost with HOLMES-OWEN Loaders. On every job, *the driver alone* can load, haul and dump — without need of other manpower or more costly equipment. A Holmes unit can be installed on almost any 1½ to 2-ton truck. It lifts ½ yard per bucket, and loads the average truck in 4 minutes. *For full information, see your equipment dealer or write us for literature and prices.*

Partial List of USERS:

- ★ **Asheville, N. C.**
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- ★ **Chicago, Ill.**
- ★ **Dayton, Ohio**
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- ★ **Monahans, Texas**
- ★ **Philadelphia, Pa.**
- ★ **Syracuse, N. Y.**
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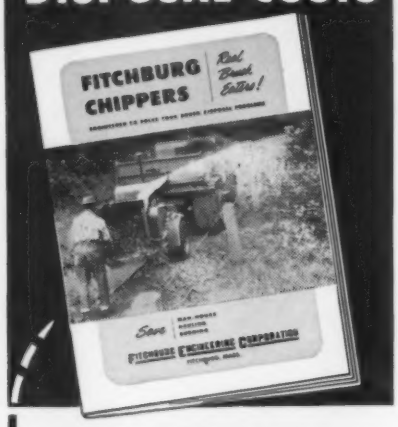
Manufactured by

ERNEST HOLMES COMPANY Chattanooga, Tenn.

Thousands use our Readers' Service card to keep up to date . . . do you?

CUT BRUSH DISPOSAL COSTS



FREE BOOKLET
tells how you save
• MAN HOURS
• HAULING
• BURNING
with an economical
FITCHBURG CHIPPER

Whatever your brush disposal problem, the new Fitchburg Chipper booklet probably has the answer for your operation.

You will read how other leading tree surgeons, power companies, utilities, and municipalities have cut disposal costs up to 50% with reliable Fitchburg "Brush Eaters."

You will see pictures of different Chipper models in action and read helpful suggestions, tips, and specifications. You will see how the exclusive Fitchburg Safety Spring works.

Tear off the coupon below and mail for your fact-packed Chipper Booklet today. Learn how a Fitchburg Chipper can cut your brush disposal costs—save you time, effort, money.

MAIL COUPON FOR BOOKLET

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Dept. PW-45, Fitchburg, Massachusetts
Please send free Chipper Booklet.

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*Company*_____
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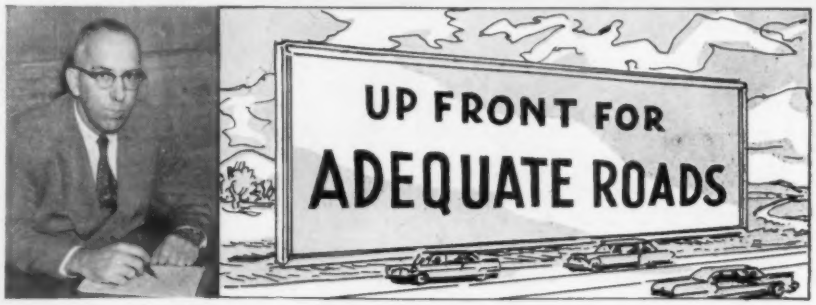


by LEO J. RITTER, JR.

The Grand Plan — In case you hadn't noticed, President Eisenhower's "grand plan" for a $101 billion highway program over the next ten years is due for rough sailing in the Congress. Two developments late in February pointed the way the battle may go. One of these was the President's message to Congress, which followed the recommendations of the Clay committee, but in which Mr. Eisenhower used decidedly lukewarm language, with words like "might", "inclined to recommend", etc. scattered through the text. The other was the introduction of a "regular" federal-aid bill by Senator Albert Gore of Tennessee (Democrat), calling for increase in federal aid to $1.6 billion per year; hearings on this bill began even before the President got his message to Congress. At this writing, there is no certainty as to what the program will actually wind up being. Principal opposition to the Presidential program comes because of two factors, other than party politics: (1) a reluctance to set up a federal highway authority with power to issue bonds, thus "avoiding" an increase in the national debt, and (2) disagreement with the toll road sections of the proposal. Gore's proposal, on the other hand—from where we sit, at least—has the drawback that such a tremendous increase in federal aid is going to leave a number of states without sufficient matching funds to participate fully in the program.

An Interesting Project—L. C. Fitts, Materials Engineer for the New York State Department of Public Works at Babylon, Long Island (pronounced Lon-Giland) described an interesting job at the recent ARBA Convention in New Orleans. Title of his paper was "Base Stabilization Using Emulsion with Heated Aggregates". The paper is a sequel to an earlier one describing the first contract let by this agency for this type of work; the section previously described has been in service for a year under relatively heavy traffic and, according to Mr. Fitts, "Periodic inspection of this road under use has further substantiated our faith in this type of construction".

In this method, the local soil (which is predominantly sand) was blended to shallow depth and loaded by crane into the bins for the asphalt plant. The blended materials were then passed through a drier and their temperature raised to about 180°F before the asphalt emulsion was added and mixed. Specifications for the work require that the moisture content of the aggregate be lowered to 6 percent or less, and temperatures as high as 220°F were sometimes necessary to achieve this objective. The big advantage of heating the aggregate, of course, is that work can be done during periods of wet weather, when mixed-in-place construction would have to be suspended.

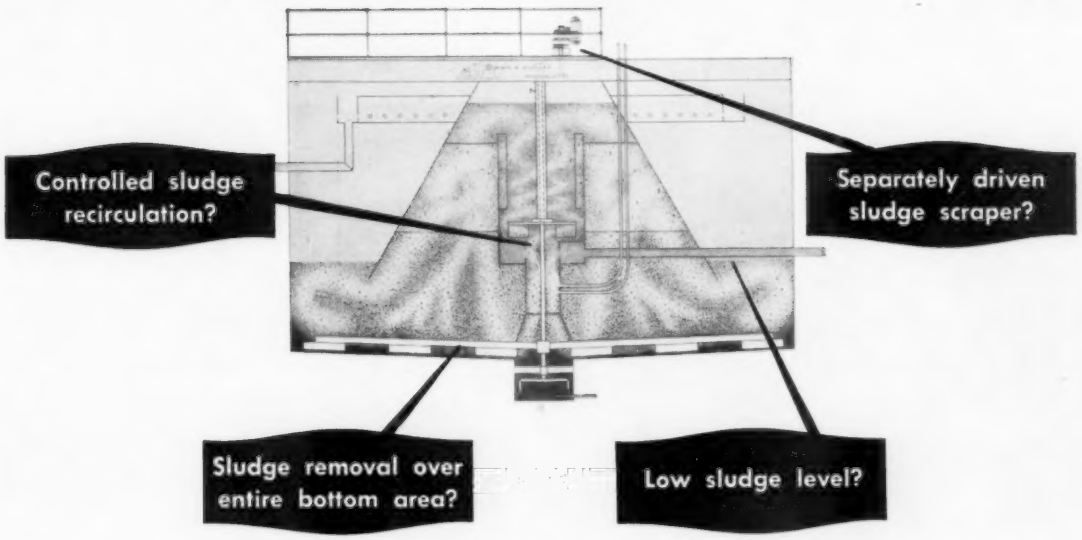
Six percent asphalt emulsion, by weight of total mixture, was all that was necessary to achieve the desired result. The base course mixture was placed in layers not more than 2½ inches thick by use of a Barber-Greene paver. Each layer was rolled by steel-wheeled rollers until no movement was observed under the roller. Additional rolling took place under traffic and the passage of the contractor's rubber-tired equipment.

This was an interesting sort of deal; although the method is not particularly new, neither is it in widespread use. There should be a lot of places where it would fit nicely into a construction program, particularly during rainy seasons.

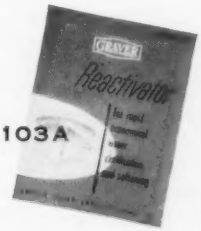
Aftermath of the Rain—Remember our brief comments some months ago about a trip we took during the October rain which flooded Chicago and its suburbs? Probably you don't, but if you should happen to think that severe rain and poor drainage don't wreak havoc with surfaced roads, you should take a trip over one of the highways in-

WHICH FEATURES...

ASSURE THE CLEAREST WATER?


Controlled sludge recirculation?
Separately driven sludge scraper?
Sludge removal over entire bottom area?
Low sludge level?

They <u>all</u> help to produce clear water. But only when all four features are combined in a single unit can you be sure of a dependable and economical supply of clear water at all times. The GRAVER REACTIVATOR®, a cold process softener and clarifier, is designed to combine <u>all</u> these features. Forty-five years of water conditioning experience have gone into this design — a design that has a proven, successful performance record in hundreds of installations.



WRITE FOR DESCRIPTIVE CATALOGUE WC-103A

GRAVER

Municipal Department: M-112

GRAVER WATER CONDITIONING CO.

A Division of Graver Tank & Mfg. Co., Inc.

216 West 14th Street, New York 11, N. Y.

Now's the time to mail this month's Readers' Service card.

Low Cost Concrete Maintenance and Restoration

The AIRPLACO portable rig cuts concrete restoration and maintenance costs and helps you stretch your budget. This completely mobile unit is made up of the AIRPLACO Bondactor or Nucretor and the AIRPLACO Mix Elvator and eliminates many man-hours and saves on material costs. Aggregates are proportioned, mixed, elevated and deposited in the Bondactor by the Mix Elvator.

The Bondactor, Nucretor and the Mix Elvator are available as separate pieces of equipment. AIRPLACO concrete gunning equipment is available with capacities from ½ to 6 cubic yards of aggregate per hour.

Relieve yourself of budget problems with job-tested AIRPLACO equipment. Whatever your concrete restoration needs, you can do it faster, better and at lower cost with AIRPLACO equipment.

Write today for complete information. State intended use and capacity desired.

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undated at that time, as we do fairly frequently. The combination of that storm, a continued high water table, and frost action have really played hob with some sections. Chuck holes, base failures, wavy bituminous pavements, and rough and spalled concrete pavements are among the damage indirectly attributable to the storm. All goes to prove, once again, that the highway maintenance man's best friend is good drainage.

Continuously Reinforced Concrete Pavements—The lead article in the February issue of *Public Roads*, research organ of the BPR, reports on 15½ years of observation of experimental sections of continuously reinforced concrete pavements in Indiana. Sections in the test road ranged in length from 20 to 1310 feet, and contained from 0.07 to 1.82 percent steel (longitudinal reinforcing). Conclusions of the study to date are:

(1) " . . . with the proper use of longitudinal reinforcement, any spacing of transverse joints within the range studied will give satisfactory performance, without failure of the steel or adverse effects on the concrete.

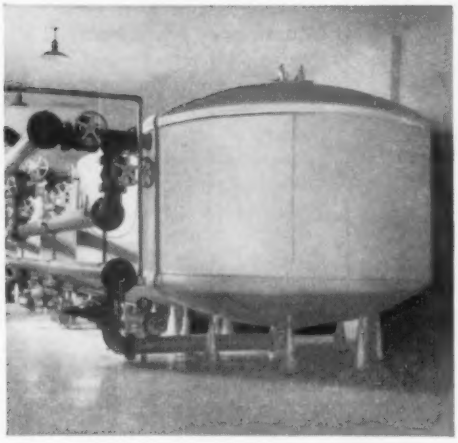
(2) "In the long, heavily reinforced sections closely spaced transverse cracks have developed, but these have not opened and are not detrimental to surface smoothness or pavement life.

(3) "Longitudinal reinforcement in very large amounts can be used without danger of cracking of the concrete above the steel, buckling failures, or disintegration of the concrete. Longitudinal reinforcement in small amount, 0.11 percent or less, should be used with caution in pavements subjected to heavy truck traffic.

(4) "The performance of the longest sections indicates that continuously reinforced pavements will be less susceptible to pumping than pavements of other designs, although under certain conditions of traffic and subgrade they will not be immune from pumping along the longitudinal free edge."

The report did not deal with the economics of this type of construction.

Just Wondering—February was a quiet month for us, with very little traveling. However, we did get to attend (briefly) one of Barber-Greene's Bituminous Construction Conferences, held at their plant in Aurora, Illinois. Andy Andreason, Ed Holt, and the other boys at Barber-Greene do a terrific job with



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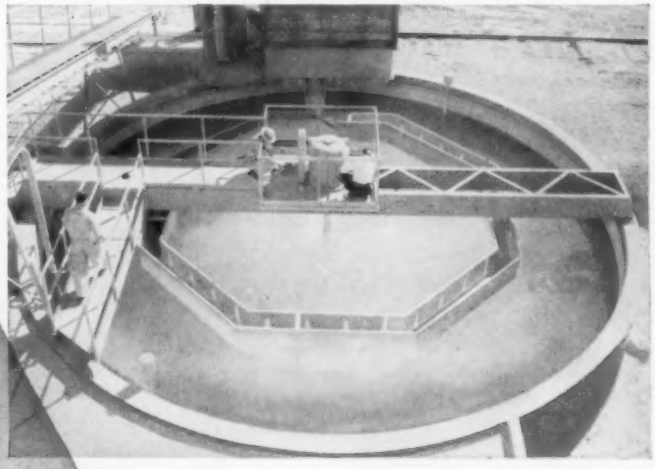

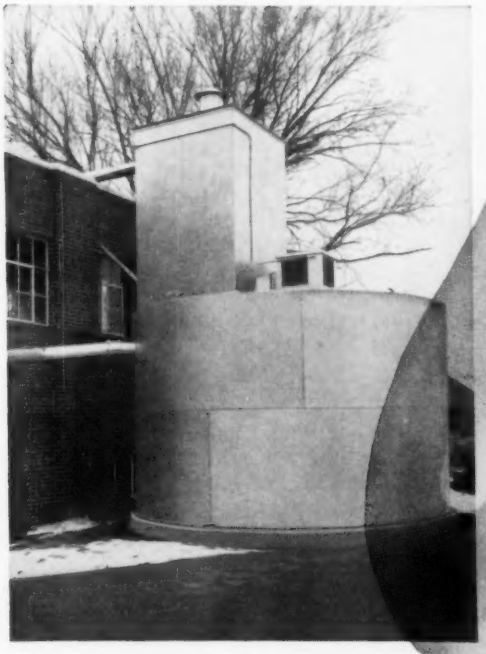

INSTALLATION SUPERVISION . . . General Filter "job-engineers" each installation to the consulting engineer's specification . . . supervises the installation and trains the personnel who will work with the equipment.

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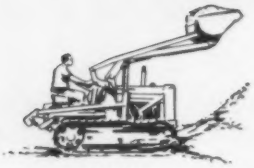
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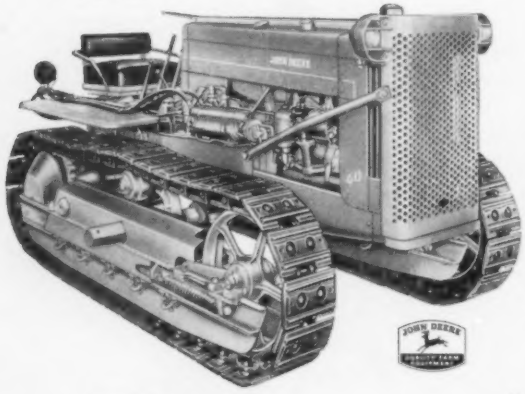

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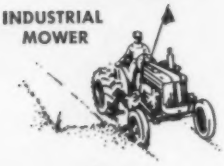
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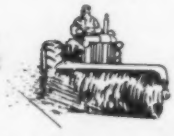
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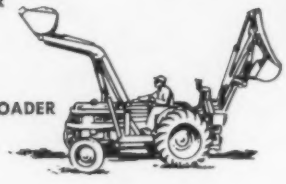
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these three-day courses, which are designed to bring together engineers from various organizations for instruction in, and discussion of, the design and construction of bituminous pavements. This particular conference was attended by some 60 engineers representing oil companies, consulting firms, engineering colleges, the Corps of Engineers, and other groups. Barber-Greene has an excellent auditorium where meetings of this type are held and the "professors" used the latest in visual aids. We are sure that any one who was able to attend, or has attended a previous one, derived a great deal of benefit from it. Incidentally, did you know that Barber-Greene is now producing a batch-type asphalt plant?

Also had a pleasant visit last month with Ted Van Zelst, major domo of Soiltest, Inc., 4520 W. North Avenue in Chicago. Found Ted and his boys preparing to move to new and larger quarters about two blocks up the street. An alert and forward-looking group, Soiltest is on top of the market in laboratory and field testing equipment (soils, asphalt, concrete, etc.). Look for an announcement soon of their new, compact universal testing machine, which can be used both in the laboratory and the field for loading specimens in the Marshall, CBR, Hveem, unconfined compression, and other tests.

From Here and There—The Florida State Road Department envisions a $99-million construction program for this year; for the first time, available funds will be distributed among the five districts according to a sufficiency rating system, rather than simply splitting it five ways. Governor Muskie of Maine has called for a $30-million bond issue for highways in his inaugural address to the state legislature. Agreement has nearly been reached for the utilization of the median strip of the Northwest expressway (Chicago) for tracks of the Chicago Transit Authority's rapid transit system. F. B. Lee, Administrator of Civil Aeronautics, has restated the basic policy of using federal aid airport money to build one runway only at new airports or to improve the dominant runway at existing airports. Three days after his inauguration, Governor Folsom of Alabama called the state legislature into special session to consider an expanded road program. A city official in Baltimore has proposed a plan by which traffic tickets could be paid off at the nearest bank. The

(*Continued on page* 72)

Mechanic and Helper* Remove Piston in Record Time

At a recent show 20,000 people tried to guess how long it would take to pull a piston on a standard production model Opposed Piston Diesel Engine.

Starting from scratch, the piston was removed and on the floor—in two minutes flat!

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*TV Actress Joan Kemp

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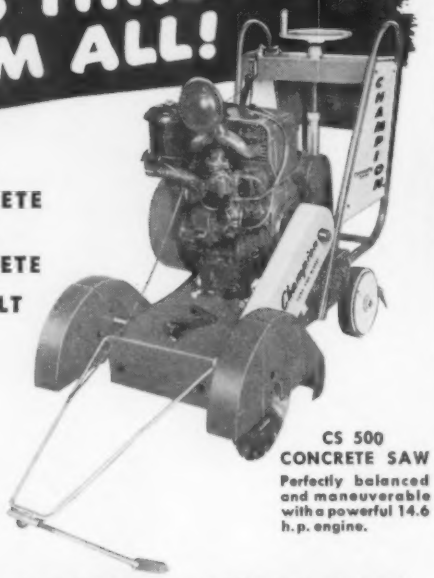

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This rugged, yet compact Champion harnesses 14.6 horses to get clean, straight bites in asphalt, green and cured concrete. Champion's compact and perfectly balanced design produces speedy cuts, saves important on-the-job time and labor costs, maneuvers easily in confined areas... cuts right into closest corners with Champion's "either-side" blade arrangement. Ask your distributor about the Champion or write direct. Champion's labor and money-saving features are worth checking into!

Sidewalk Patching with a Champion. Even well-cured, dense concrete like this is zipped through faster — and for less — by a Champion.

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use slow-dissolving **HTH TABLETS**

For economical, effective disinfection of new water mains and extensions, a new procedure using HTH Tablets has been developed that eliminates the principal objections to other methods. Pioneered by J. R. Rossum, sanitary engineer, California Water Service Co., San Jose, Calif., this method has been employed on several hundred jobs with exceptional results.

HTH Tablets are fastened to the interior top of the pipe with hot tar or a suitable gasket cement. When the pipe is filled, density currents generated by the solution of the chemical carry the hypochlorite solution a distance of several pipe lengths. Since the HTH Tablets remain in place and dissolve slowly, the disinfectant is not washed to the far end as the main is filled. The table shows how to obtain a minimum chlorine dose of 30 ppm.

Length of Section	Diameter of Pipe Line or Main 2″	4″	6″	8″	10″	12″
13′	*1	1	1	2	3	3
18′	1	1	2	2	3	5
20′	1	1	2	3	4	5
30′	1	1	2	4	5	7
40′	1	2	3	5	7	10

*Recommended number of HTH Tablets to be used per section.

For full information on the use of HTH Tablets for the disinfection of new mains, see your HTH supply house or write today.

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One application of

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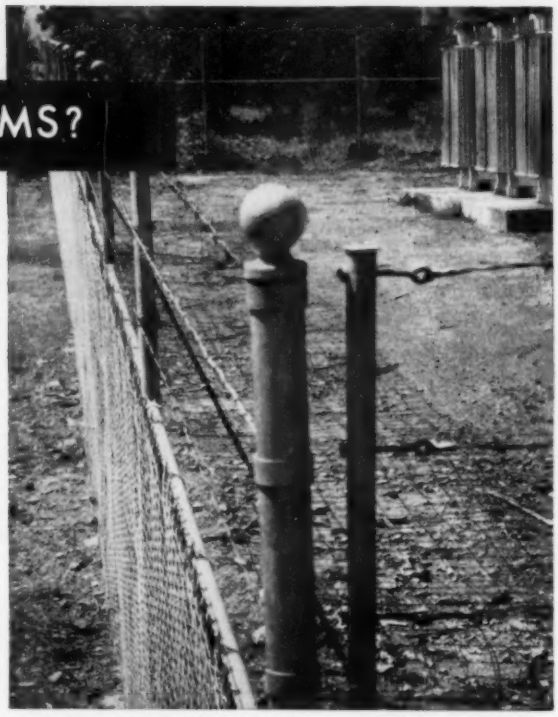
stops weeds for the season—or longer!

"Telvar" kills weeds through the roots . . . prevents regrowth. Low rates (20 to 80 lbs. per acre) make it cost little for the results you obtain . . . also mean less handling, fewer storage problems. To cut maintenance costs to new low levels, put "Telvar" in your weed-control program. Available in two formulations: "Telvar" W, and "Telvar" DW.



Note thorough job "Telvar" did around this fence. "Telvar" won't corrode fence or equipment, it's low in toxicity to humans and animals, non-flammable and non-volatile.

BRUSH ON RIGHT-OF-WAY?

Above—Right-of-way being treated with "Ammate." Below—Three years later, brush is still under control. "Ammate" allows low-growing cover to return to resist erosion.

One application of

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WEED AND BRUSH KILLER

kills more kinds of brush —safely—at lower cost!

"Ammate" kills more kinds of brush and keeps it down longer than most weed and brush killers! When the original spray job is done well, brush is kept under control for years with only an occasional spot spray. You can rely on "Ammate" to do the job safely, even where your right-of-way adjoins cropland, because "Ammate" is not volatile. There are no vapors to drift onto sensitive crops. It is no hazard to crews, stock or wildlife.

FREE ILLUSTRATED BOOKLETS describe how to control weeds and brush with Du Pont chemicals. For your copies, write to Du Pont, Grasselli Chemicals Dept., Rm. 4032, Wilmington, Del. In Canada, Du Pont Company of Canada Limited, Box 660, Montreal.

On all chemicals always follow directions for application. Where warning or caution statements on use of product are given, read them carefully.

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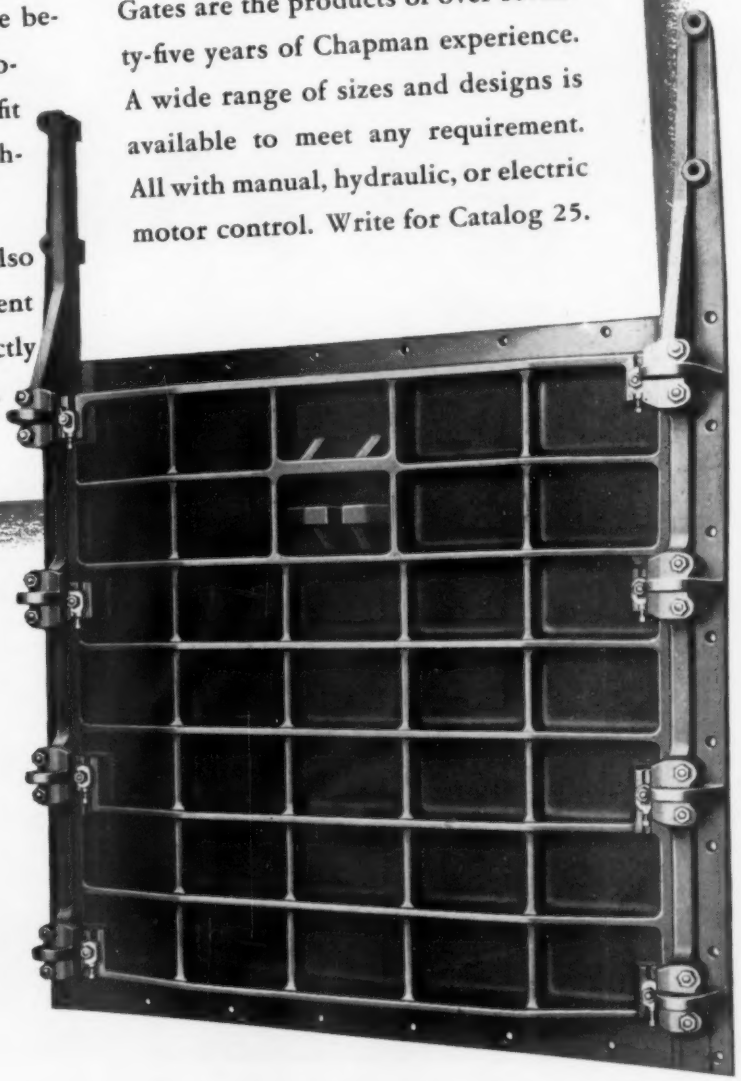

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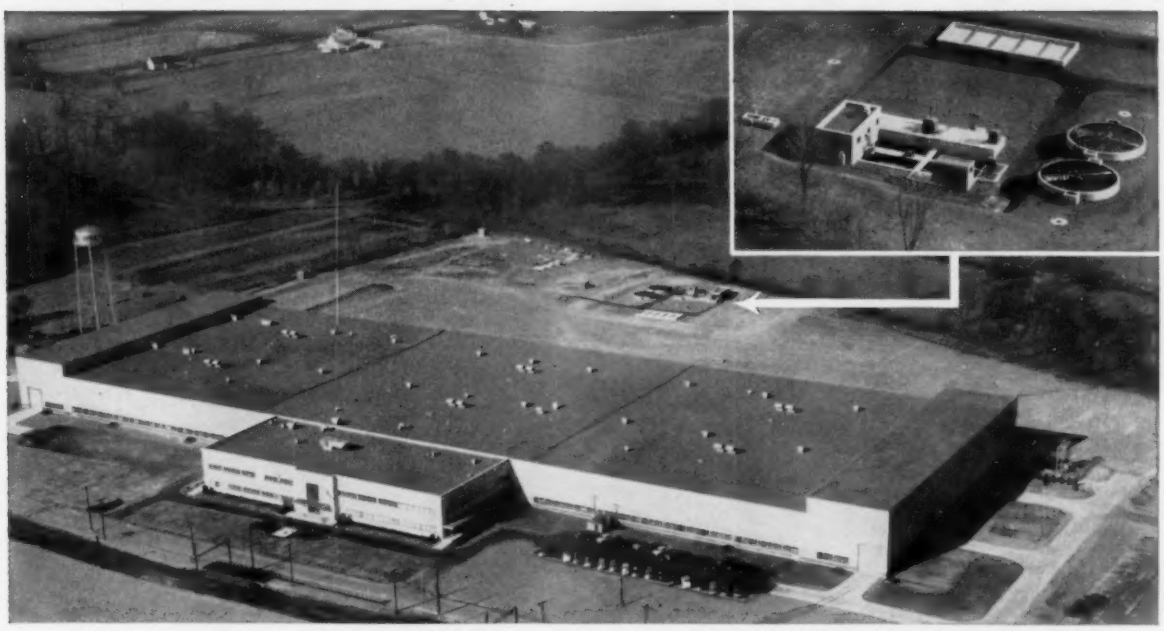
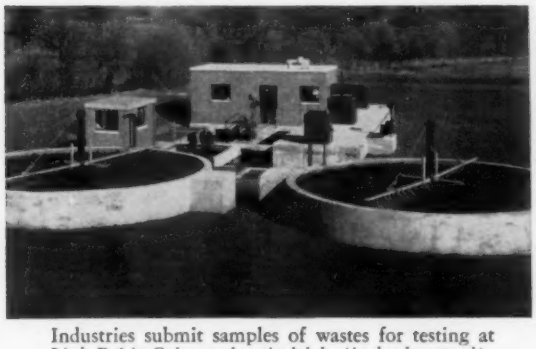


Sewage treatment plant (inset) serves Link-Belt Company Plant at Colmar, 25 miles outside Philadelphia. Except for chemical laboratory used by Sanitary Engineering Dept. for customer service, it's a typical Link-Belt system.



Industries submit samples of wastes for testing at Link-Belt's Colmar chemical lab (in background).

Straightline collectors are used in primary and final settling tanks. Here operator tilts scum pipe.

Clean up industrial wastes

with Link-Belt equipment engineered to your exact needs

TODAY waste treatment must be considered as part of the manufacturing process. In moving from metropolitan areas or locating at rural sites, many plants find it necessary to treat their own liquid industrial and sewage wastes. This is particularly true with increased anti-pollution legislation, both State and Federal.

Link-Belt is a highly qualified designer and manufacturer of waste treatment equipment. More, Link-Belt recommendations represent cumulative judgment acquired in many installations—not only in industrial wastes, but on large municipal water and sewage treatment plants as well. In many cases, Link-Belt's combination of design and quality equipment has enabled industries like steel, chemical processing, canning, packing, paper and many others to reclaim valuable by-products while reducing pollution.

Whether your plant is rural or urban . . . call your nearest Link-Belt office. Our specialists—cooperating with your own engineers, chemists and consultants—will work out the finest in modern water or waste treatment plants for you. Here you can also get expert advice on your complete conveying and power transmission needs.

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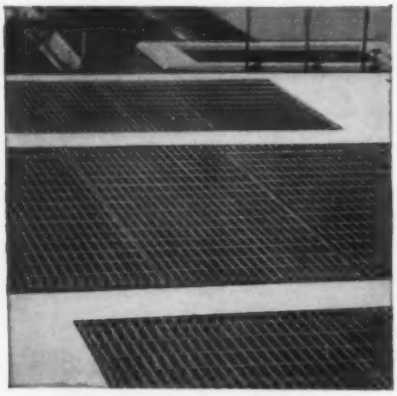

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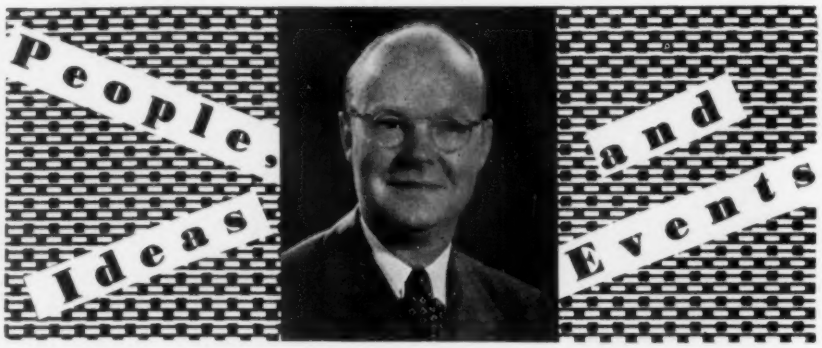


by "Doc" Symons

H.T.M.A. — And now is the time to remind you that it is only two months until the AWWA meeting in Chicago, June 12-17. Do you have your reservations yet?

★ ★ ★

Express Highways and Sanitary Engineering—Among others, I heard Bert Tallamy, Chairman of The N.Y. Thruway Commission, talk at the luncheon of the NYSIWA Meeting in New York City in January. Tallamy mentioned the problem of water supply and sewage disposal for the many service stations along the 427 mile N. Y. Thruway. Other problems included water and sewer line relocation caused by the Thruway in many areas.

Bert called attention to the Eisenhower Highway program and pointed out that it called for 40,000 miles of express highways. Just think what a lot of problems of water supply, sewage disposal, water main and sewer relocations all of those highways will cause. There's big business ahead in Sanitary Engineering in the highway program.

★ ★ ★

During a meeting of the Local Arrangements Committee, for the Federation Convention in Atlantic City, Cliff Irving, new President of NYSIWA sat in and mentioned his desire to schedule a special train to the Federation Los Angeles Meeting in '56—Might be a good idea! — And while you're planning don't forget Atlantic City in '55. And, as to the future, it's not definite, but it looks as though the Federation Meeting schedule will read like this—'55-Atlantic City; '56-Los Angeles; '57-Boston; '58-Detroit; '59-Dallas; '60-Philadelphia; '61-Toronto; '62-Denver.

★ ★ ★

Swedefinition — True Musician—a man, who, when he hears a lady singing in her bath—leans over and puts his ear to the key hole.

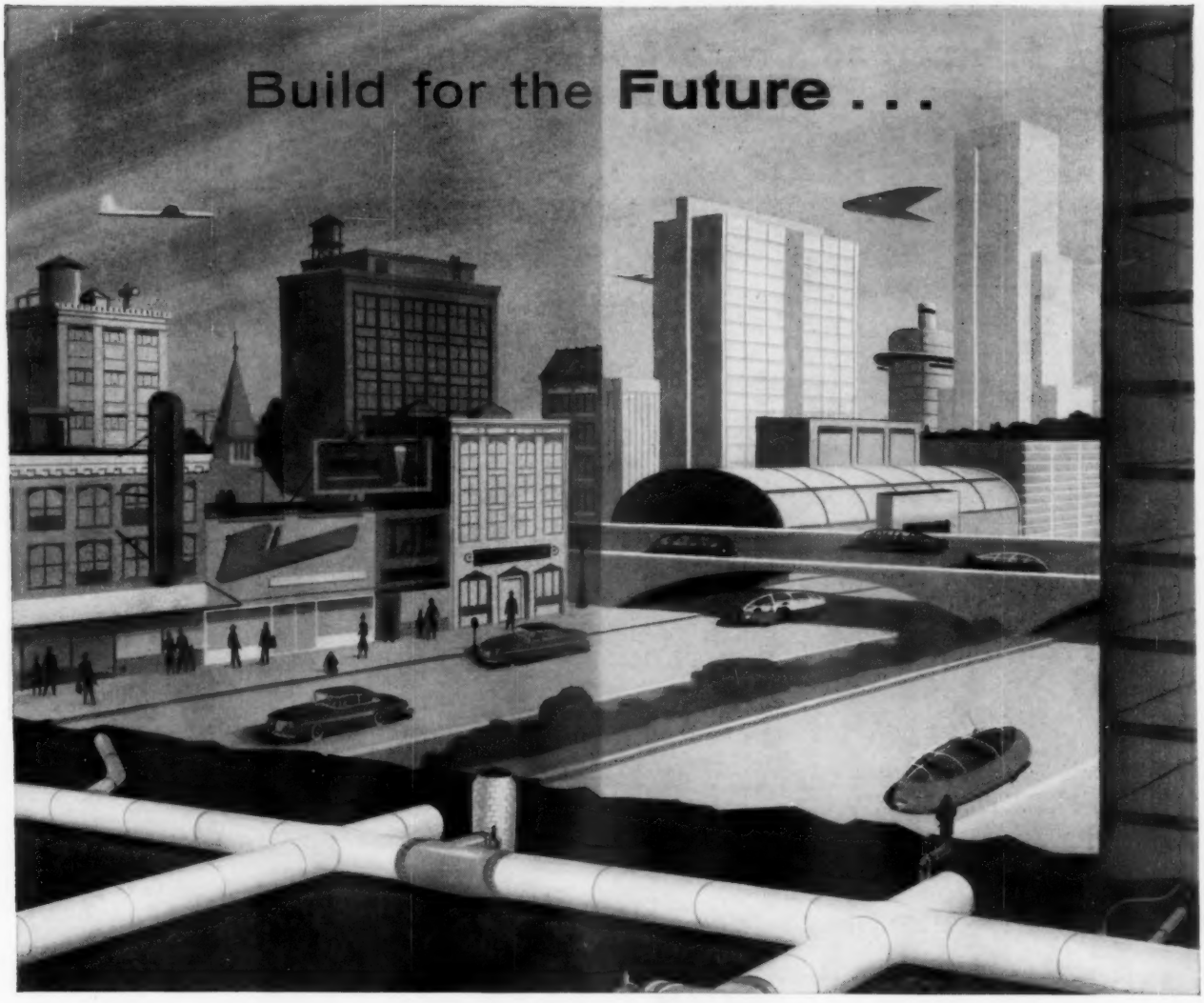
★ ★ ★

Who Attends Conventions? —At the N. Y. Section (AWWA) Annual Mid-Winter Luncheon, Wendell LaDue of Akron, Ohio, Burton Grant of Los Angeles, Frank Harmstad of R. D. Wood Co., and I had a real lively discussion about how many persons attended AWWA Conventions and who they are.

Wendell argued that if the manufacturers would agree that they needed less exhibit space, the AWWA Conventions could be held in many more cities than are now available with enough auditorium space. "Thus," said Wendell, "the meetings would draw more superintendents (i.e., customers) which is what the manufacturers want."

My argument was that, apparently, it matters little where the meetings are held. Each year about the same number of operators, superintendents and engineers attend although the membership roll of AWWA continues to grow. Each year the registration at conventions has shown an increase in ladies attending but no gain in operators, superintendents, etc. For example, here are the registration figures for the past three years:

Year	Place	Oper.-Supt.-Engrs.	Mfrs. Reps.	Ladies	Total
'54	Seattle	901	635	527	2063
'53	Grand Rapids	879	653	365	1897
'52	Kansas City	914	686	386	1987



on a Lock Joint "Foundation"

City planners and engineers are taking a long, hard look at everything connected with water supply — the most serious problem affecting the city's future growth. That's why so many cities, all over the world, have selected Lock Joint Pressure Pipe's greater security, more dependable performance, longer life. They know that their plans for meeting future water supply requirements must include pipes whose high carrying capacity will be as great scores of years from now as it is today.

In addition to a solid foundation for the water supply system of the future, Lock Joint Pressure Pipe offers important economies — low first cost, economical installation, low pumping costs and negligible maintenance charges.

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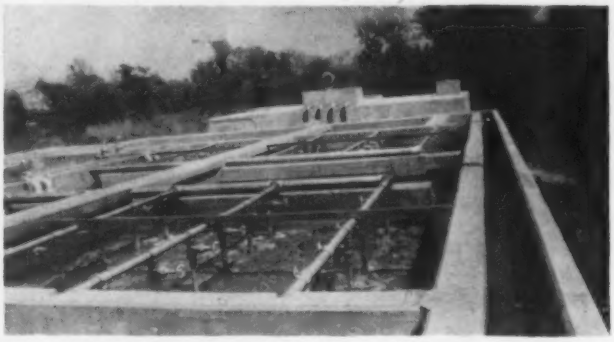

5,000 population Contact Aeration Plant built in 1948 for City of Lake Jackson, Texas. This City has let a contract for an additional 10,000 population Contact Aeration Plant for sewerage treatment.

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That ratio of operators-engineers to manufacturers representatives is fairly stable at about 1.36 to 1.0. Any suggestions for increasing it to about 2 to 1???

★ ★ ★

While on the subject of AWWA Convention attendance it is interesting to note that of the total AWWA membership, manufacturers' representatives account for only 16 percent while superintendents, managers, engineers, operators, etc. account for 61 percent. At meetings, however, the manufacturers' representatives account for 33 percent of the attendance, the ladies for 22 percent and the superintendents-operators-engineers for only 45 percent.—What's wrong???

★ ★ ★

Swedefinition — True Musician—a man, who, when he hears a lady singing in her bath—leans over and puts his ear to the key hole.

★ ★ ★

Natal Day—And this is the month when I meet another birthday head-on. Oh well—I haven't had much hair for years, I'm a slave to trifocal glasses, and stairs are higher and steeper than they used to be—but I'm learning to dance the Mambo, so who cares about birthdays.—Sigworth, please note!

★ ★ ★

Belated February item—Didn't have room for this item before but don't want to hold it another year. Here 'tis.

Lincolnania — In a Newcomer Lecture a few years back, the President of Worthington Corp. talked on the founder of the company, H. R. Worthington, inventor of the duplex direct-acting pump.

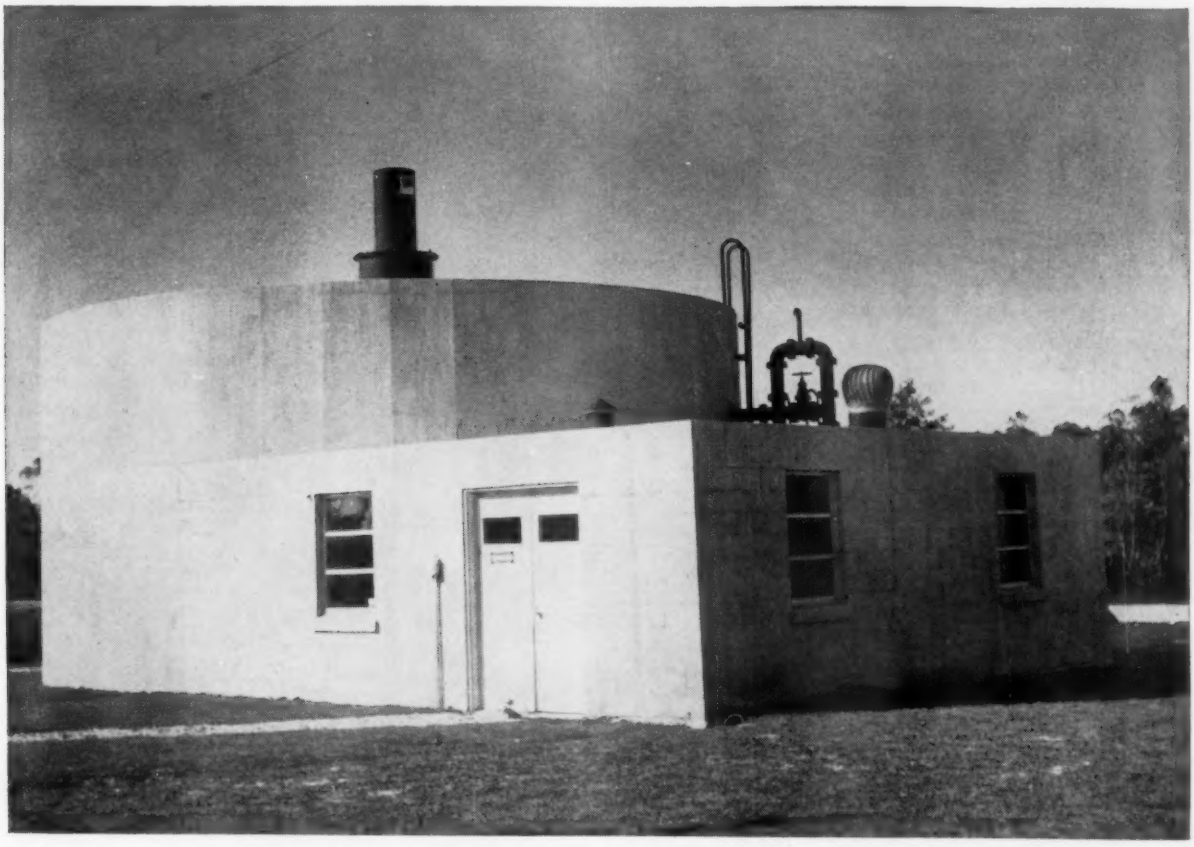
In his talk he told this story—

"During the war between the states, a Worthington pump used to supply water to the White House was not working right. No one around the White House could fix it, so Lincoln went to Union Army Headquarters for an Army Engineer, Capt. B. F. Church, (later Div. Engr. of the Croton Water Supply for New York City) and drove back with him to the White House.

"Lincoln removed his coat and announced that he was ready to go to work. Together he and Church located a worn valve and replaced it.

"Lincoln, joyously flourishing a monkey wrench held in a large and greasy hand, exclaimed, "Well, we

Florida's big clean-up moves ahead!



Progressive Eustis, Florida Adopts
PFT "CONTROLLED DIGESTION"

Joining Tallahassee, Tampa, Orlando, and other Florida cities, Eustis is taking part in a great *state-wide* sewage treatment program! Eustis, like the larger plants mentioned (and others under construction), chose modern PFT equipment for effective treatment through "controlled digestion."

Designed for complete treatment of a 5,500 population equivalent, the plant commenced operation in June, 1953. Treating a sewage flow of 100 gallons per capita per day, it uses high rate filters with chlorination and discharges into Trout Lake, a tributary to Lake Eustis.

Essential to the plant's effective treatment is the *PFT Floating Cover* for the 30 ft. digester (13,280 cu. ft. capacity). Floating Covers accelerate digestion by providing positive scum submergence. They simplify operations by eliminating the need for fixed levels—additions and withdrawals can be made at times best suited to the over-all operation.

In addition, Floating Covers reduce explosion hazards because gas collected under the cover is maintained at positive pressure under all operating conditions. Costly breakdowns are reduced because all moving parts are eliminated from inside the digester. Since heat is supplied from *external* heaters, all cleaning and maintenance take place *outside* the tank.

Other PFT equipment installed at Eustis includes: *Heater & Heat Exchanger unit* (100,000 B.T.U. per hour); *Flame Traps; Pressure Relief Waste Gas Flame Trap; Waste Gas Burner; Auxiliary Flame Cell; Gas Pressure Gauge; Drip Taps.*

The Eustis plant has demonstrated that PFT equipment can serve the smaller as well as the largest cities. In all installations, PFT assists consulting engineers by showing the adaptability of its equipment in meeting specific plant requirements.

Design of plant by / *Briley, Wild & Associates, Consulting Engineers; Daytona Beach, Fla.*

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waste treatment equipment exclusively since 1893

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have done what no other two men in Washington could do!'"

★ ★ ★

News Notes from Brushy Bend—Feb. 2 The Sanitary Engineering Group of the Metropolitan Sect. of ASCE, held a discussion of the requirement of state regulatory agencies in regard to approval of construction plans. Three State Directors of Sanitary Engineering participated: Earl Devendorf, New York; Warren Scott, Connecticut; Alfred Fletcher, New Jersey.

Feb. 4—North Jersey Water Conference heard Martin Flentje, Research Engineer, Amer. Water Works Service Co., talk on "Operation Problems of a Small Water Works."

Feb. 18—The North Jersey Water Conference had a panel discussion on Specifications Applicable to Water Works.

Feb. 28—Long Island Water Conference met at Lincks in Centerport.

Mar. 15-16—The 8th Municipal and Public Health Engineering Conference was held at the University of Florida at Gainesville. The subject of the meeting was "Water Management in Florida."

V.T.Y.-Doc Symons

• • •

White-Way Street Lighting System

Installation of a white-way street lighting system for the business district of Slater, Mo., has been completed with the cost shared between the city government and the abutting property owners. The property owners are paying about $1200 to provide 25-foot metal poles and brackets. The city is paying $2400 to cover luminaires, wire, transformers, regulators, and installation costs. The system will use mercury-vapor lighting.

• • •

Up Front for Adequate Roads

(*Continued from page* 60)

"scramble system" is now being used at four intersections in downtown San Francisco; likewise, a few in downtown Washington, D. C. Part 1 of the State of Washington Engineering Soils Manual, "The Engineer and Pedology", is now available from the Washington State Council for Highway Research, 121 Moore Hall, University of Washington, Seattle. (Price; 50 cents.) Experimental sections incorporating welded wire fence, bituminous road mesh, and expanded metal mesh in bituminous resurfacing have been built on a section of U.S.-40 near Vallejo, California.

Personalities in The News— W. A. Blasingame, a druggist, is the new chairman of the Georgia State Highway Board. H. E. Lewis has become chief highway engineer of the Florida State Road Dept., replacing Robert Gupton. Meanwhile, Sam Turnbull has returned to Florida as chief engineer of the Florida Turnpike Authority. T. J. Kelly, former district engineer of the Texas Highway Department, has joined the staff of the Texas Engineering Experiment Station to do research in highway soils problems. Edward M. Howard, formerly of the Asphalt Institute staff, has been named Field Engineer for the Wire Reinforcement Institute, with headquarters at Springfield, Illinois. A former student of ours at the University of Florida, Wade Thomson, is county engineer of Madison County, Tennessee; doing a fine job, too, we hear. Harmer Weedon, Professor of Highway Engineering at Bucknell, is leaving at the end of the year to take a similar post at Penn. State.

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The versatility of Tractair, since it is a combination 35-hp wheel tractor and 125-cfm compressor, can save you money, too. You can use it for drilling, tamping, driving form pins, breaking pavement, and a host of "odds and ends" jobs. Write for complete details. T-34

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Whether it's a large culvert, a chain link fence, or a fence post, remember, if it's iron or steel, have it Hot-Dip Galvanized. For the best in galvanizing, send your products to a member of the American Hot Dip Galvanizers Association . . . he has the know-how to give you a top quality job.

Send today for our new booklet "Stop Rust." It gives you the full story on the process, plus a comprehensive coating comparison chart. "Must It Rust" 16 mm film available for showing.

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Spring clean-up time is LOAD-PACKER time!

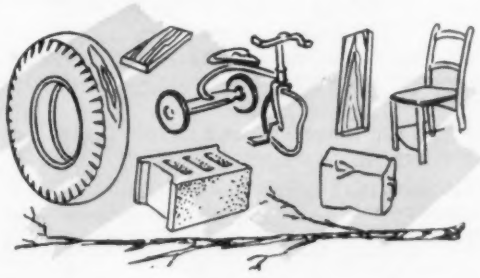
Everywhere across the nation, city officials are finding that taxpayers cooperate more readily in sanitation programs when the collection job is handled by modern, fully-enclosed Gar Wood Load-Packers. This is because Load-Packers collect *both* garbage and trash, in less time, with less muss and fuss — and at much lower cost to the community.

Double compaction of both ram and retaining panel, plus positive retention of compacted materials, enable Load-Packers to carry extra payloads every trip. This means you need fewer units, fewer men, fewer trips to the dump, resulting in lower net cost per year for operation and maintenance.

Leak and odor proof: Load-Packer design eliminates dripping, blowing refuse, insures a more healthful community . . . eliminates complaints from taxpayers.

A free demonstration will quickly show you why the Load-Packer method is *preferred 4 to 1* over all other types of collection systems combined. Write today. Gar Wood Industries, Inc., Wayne, Mich., Richmond, Calif.

Loads Anything! Loads Faster!



Powerful Load-Packer loads and compacts anything that fits into the large hopper. No need for selective loading. In addition, Gar Wood's extra-wide hopper, low height and fast loading cycle, permit faster, lower-cost collection, with less strain on loaders.

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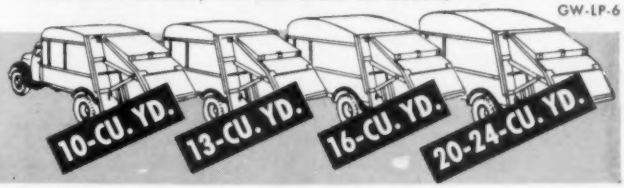
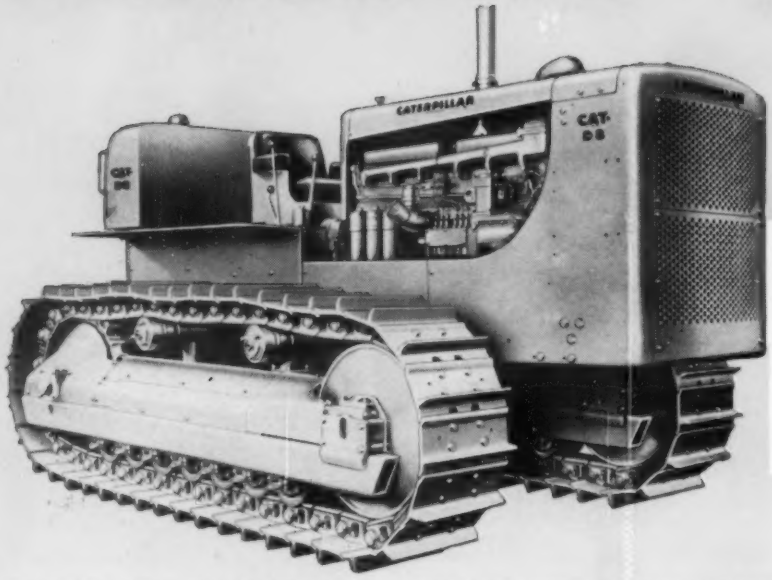
LOAD-PACKER

America's Most Popular Refuse Collection-Unit



CATERPILLAR ANNOUNCES THE NEW D8



SERIES D and SERIES E

Choice of torque converter (Series D) or direct drive (Series E)

Here's a major advance in tractor design—the new CAT* D8 Series D and Series E. While it still bears the name of the unit that earned world-wide recognition as "boss of the crawlers," it is basically a *new* machine.

From its new 7-track roller track frame to its new engine, 155 HP at the drawbar and 191 HP at 1200 r.p.m., it is built to set new standards of money-making production. Along with its advance-design features, it retains such outstanding Caterpillar exclusives as the oil clutch and other job-proved developments. As a result, you can figure on it for *more* work at *lower* cost with *less* down time on *any* job.

Production-wise and profit-wise, you have a new yardstick of performance in the D8 Series D and Series E. For complete details, see your nearby Caterpillar Dealer.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

***NEW* ENGINE,** with new fuel injection system. Flanged center main bearing to take crankshaft thrust. Timing gear integral with crankshaft. Many other advantages.

***NEW* "LIVE-SHAFT" DRIVE,** independent of flywheel clutch, provides constant power for rear-mounted cable controls, etc., whether or not tractor is in gear.

***NEW* ONE-PIECE WELDED STEERING CLUTCH CASE**—main frame assembly for a stronger "backbone." Transmission removable without disturbing clutch.

***NEW* "EASY WORKING" CONTROLS** handy to comfortable, one-man seat. New streamlined hood for visibility.

***NEW* OPTIONAL DRIVE,** torque converter or direct drive. Torque multiplication of 5 to 1 gives smooth, efficient operation in each speed range.

***NEW* 7-ROLLER TRACK FRAME FOR GREATER STABILITY,** flotation and better ride.

***NEW* "WATER-QUENCHED" TRACK SHOES** for longer life than ever before.

***NEW* "IN SEAT" STARTING** for greater convenience, with new, more powerful starting engine for faster starts in any weather.

***NEW* HYDRAULIC BOOSTER STEERING,** independent of flywheel clutch, for maximum steering ease.

***NEW* 118-GALLON FUEL TANK,** large enough for normal 12-hour operation.

***NEW* ATTACHMENTS** include new cable controls. Also, new, larger bulldozer blades. All equipment used on the D8 can be used on the new D8 Series D and Series E.

NEW operating weight—D8 Series E (direct drive), 40,430 lb.; Series D (torque converter), 41,265 lb.

AND MANY OTHER NEW FEATURES!

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I'd like more information on the new D8 Series D and Series E

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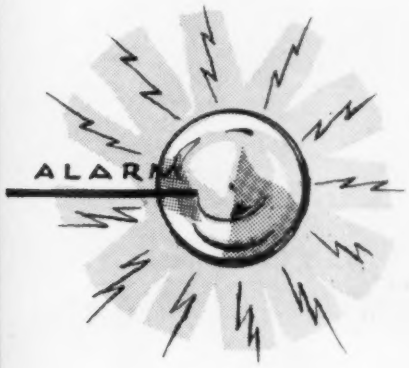
The NEW D8 Tractor —another example of CATERPILLAR LEADERSHIP in action

Detecting Sewage Gas LEAKS AUTOMATICALLY

POSITIVE and automatic detection of gas leaks at the new $3,500,000 sewage and garbage treatment plant of Canton, O., is assured by an instrument that automatically and continuously analyzes atmospheric samples in the plant's digester building. Because the plant produces, handles and stores between 325,000 and 350,000 cubic feet of highly combustible gas daily, the scientific detection of leaks in piping, valves, meters and storage tanks is considered essential.

The digester building, housing a total of 10 primary and secondary digester tanks, is equipped throughout with spark-proof motors, explosion-proof lighting fixtures and similar protective accessories. But protection of personnel and property is strengthened by the combustible gas analyzer and alarm system. Moreover, since operation of the plant depends entirely on gas produced, the system provides a safeguard against interrupted service.

Designed and developed by Mine Safety Appliances Company, the system at Canton is arranged to draw air samples from four strategically located points between the two rows of 90-foot diameter, 23-foot deep reinforced concrete digester tanks. Air is drawn from sampling locations to the analyzer through copper tubing by a turbo-compressor pump, powered by a ¼-horsepower explosion-proof motor, installed on the Combustible Gas Alarm panel. Samples are passed over a detector filament which instantly determines the percentage of combustible gas in the sample. The analyzer is calibrated to sound an alarm when methane—principal constituent of sewer gas—in the sample reaches 40 percent of its lower explosive limit. At that point, the instrument automatically energizes an alarm horn and shows by red indicator light on the panel the exact location from which the contaminated sample was taken.



● **INSTRUMENT continuously samples air drawn from four locations in the digester building; sounds alarm when methane content reaches preset limit.**

An added advantage of the system is its control of exhaust fans in the digester building. Although the fans are equipped with switches for manual operation, when desired, they are set up to go into action when the analyzer detects combustible gas concentrations. This conserves electricity because the fans have to be operated only when the atmosphere in the building is contaminated by gas. There is one exhaust fan for each sampling location. Fans are recessed in the concrete roof of the building and discharge to the outside through hoods with flashback arrestors.

Officials of the plant report that the analyzer has operated on several occasions, detecting sewer gas leaks, sounding an alarm and actuating the exhaust fans. Periodically, the instrument is checked with a known concentration of methane gas. A built-in air flow meter, readable on the instrument panel, indicates to an inspector that the air samples are passing through the unit properly.

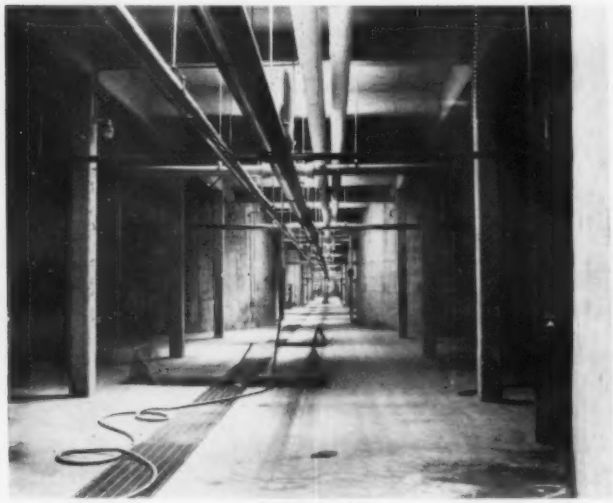
The Canton plant, designed to handle an estimated future population of 160,000, presently serves approximately 130,000 urban and suburban residents. It handled in 1953 an average of 14.39 million gallons of sewage per day, plus 30 tons of raw garbage. Design of the plant is based on a flow of 30 million gallons per day. The garbage is ground, washed and pumped directly to the digesters, but can be routed to the grit basins and thence through the plant.

Gas produced in the digester tanks has an average 600 BTU content. It is used for heating buildings and water and for fueling the engines that drive blowers and pumps. The plant has nine engines—three 390-hp Worthington; three 200-hp Climax; and three 23-hp Buda. These are all powered by sewage gas. The three Worthingtons drive 7000-cfm Roots-Connersville blowers; the Climax engines are each direct-connected to an 18-mgd Worthington raw sewage pump; the Buda engines drive Worthington return sludge pumps. The engines are located in the main administration building. Because an uninterrupted supply of gas is essential to

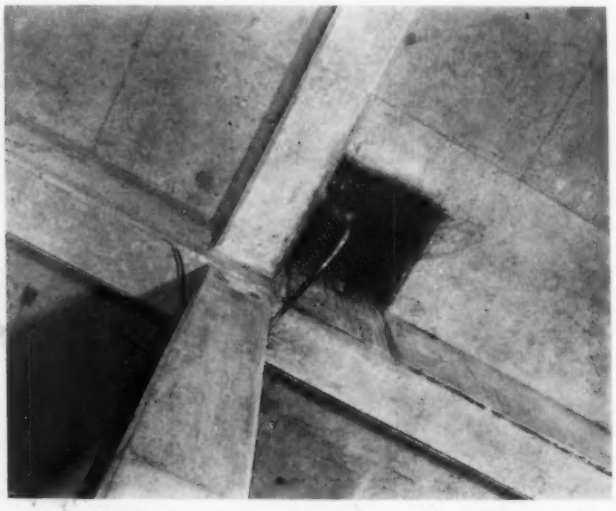
the plant's operation, the analyzer system assures continuity of service. Based on a commercial rate of 40 cents per thousand cubic feet, the estimated savings from use of sewer gas is $120 per day.

Gas is collected in the domes of six primary digester tanks which are heated to 95 degrees by pipe coils for complete and rapid gasification and digestion of sludge solids. Excess gas is piped into the four secondary digester tanks which are equipped with floating steel covers and have a total capacity of 240,000 cubic feet. Digested sludge is pumped to a 600-acre disposal area five miles south of the plant. Digester equpment was furnished by Dorr-Oliver Co.

The Canton plant was designed by Alvord, Burdick and Howson, Chicago consulting engineers. It was built by the Bass Construction Company, Birmingham, Michigan. G. F. Johnson, plant superintendent, furnished a portion of this data.



● MAIN corridor between digesters at Canton plant.



● AIR sampling location near fan in corridor roof.

Highway Pavements at Railway Grade Crossings

H. M. TAYLOR, JR., Office Engineer, Bridge Division, Texas Highway Department

WHILE traveling on the state's highways the public crosses many different types of railroad grade crossing pavements, varying considerably in quality of smoothness and easy riding. It is intended to describe briefly the principal types now in use in Texas and comment on some of the advantages and disadvantages that have been observed. The five types which will be discussed are as follows:

1. Full asphalt pavement on flexible base.
2. Asphalt pavement with treated timber headers along both sides of the rails.
3. Treated timber pavement for full length of ties.
4. Concrete slab pavement.
5. Metal grating.

Asphalt type pavements have been installed on a great many county road crossings and during World War II were installed on some of the state's highways due to the scarcity of treated timber. Because the initial cost of this type is less than the other types the railroad companies have used them considerably on lightly traveled county roads. This type has not proven satisfactory due to the breaking up of the asphalt caused by movement of the ties under train traffic as can be noted in the photo. The Department objects to the installation of the full asphalt crossing pavement on the state's

Photos and Text Courtesy "Texas Highways"

● REINFORCED concrete slab completely encases railroad ties at grade crossing.

highways. Maintenance of this type of crossing runs high if proper maintenance is provided.

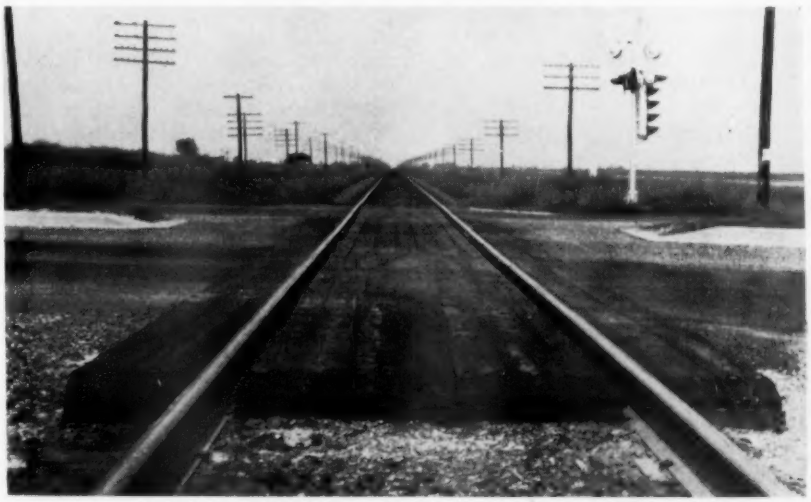
Asphalt crossing pavement combined with treated timber headers along both sides of the rails are now being used on city street crossings a great deal. While it is a little better than the full asphalt type, it is still not considered desirable on the state's highways for reasons similar to the full asphalt type.

Full treated timber crossing pavement from end of ties for the crown width of the highway is the type the Department most frequently requests the railroad company to install. In Texas the statutes require the railroad companies to install and maintain crossing pavements at no cost to the state. This type has proven reasonably satisfactory since it can be maintained or replaced by the railroad's maintenance crew without much interruption of highway traffic. This type is not affected as much by the movement of the ties under heavy train traffic as are the asphalt-type crossings.

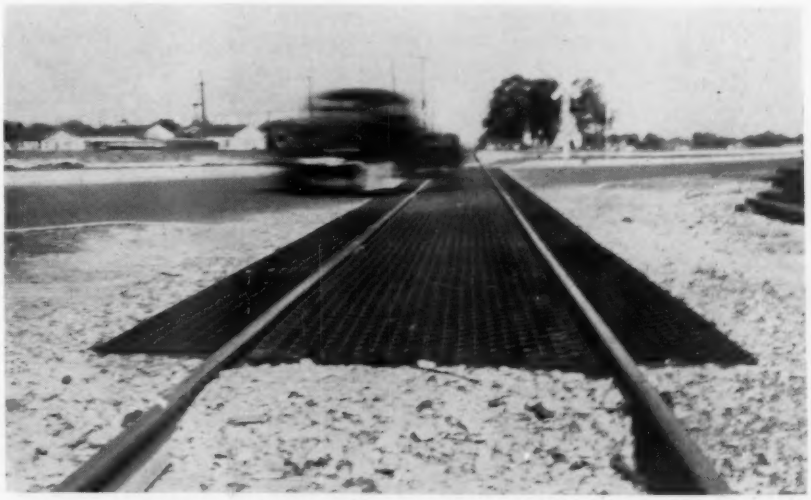
The reinforced concrete slab type crossing, which entirely encases the ties, has generally been required by the Department in instances where new industrial spur tracks cross the highway. Because, as a rule, industry spur tracks are owned by the industry, and in the past it has been found that maintenance of such tracks has been neglected, it is considered desirable to have initially a type of crossing pavement installed that will require a minimum of maintenance. This is provided by the concrete slab type. With this, a smooth riding surface is assured which stands up and has proven very satisfactory from the highway viewpoint. Because the initial cost of this crossing is considerably higher than timber pavement and because once it is installed any future changes in the elevation of the highway or railroad track usually necessitates removal and replacement of the entire crossing, resulting in an additional cost to the railroad company, this type meets with some objection by the railroads. The Highway Department's policy is to construct and maintain the highway surfacing up to the end of the ties at the tracks without cost to the various railroads.

The metal grating type is being used as an experiment at one location in this state and has been observed and studied closely. This type presents an excellent riding surface; however, its cost is slightly more than the concrete slab type.

● **HIGH MAINTENANCE** costs may result where edges of the asphalt pavement are not protected at sides of the rails. Note how movement of ties has caused breakup.



● **TREATED TIMBER** pavement for the full length of the ties is favored by the Highway Department but is more expensive for the railroad companies to install.



● **EXPERIMENTAL** metal grating apppears to be very satisfactory. Riding qualities are excellent; tie movement effect is minimized and little maintenance is needed.

Chemical Control of Roadside WEEDS and BRUSH

A Letter from JOHN L. FARLEY, Director Fish and Wildlife Service, U.S. Department of the Interior

IN order to have on the record an official statement from the Fish and Wildlife Service, the Editor of PUBLIC WORKS wrote to Mr. Farley asking for his views in respect to the use of chemicals for controlling roadside weeds and brush. Mr. Farley's reply follows:

"I appreciate receiving your letter of January 18 and the opportunity to present the views of the Service with regard to the chemical control of roadside weeds and brush.

"Here, as with most controversies, a middle ground appears to exist on which conflicting interests can be resolved and integrated. There can be little question as to the need for control of roadside weeds and brush. Traffic visibility and safety are of prime consideration on the highway. There is ample justification for removal of vegetation that obstructs the view at road intersections or that causes excessive drifting of snow on the highway, or that results in poor drainage which in turn causes rapid deterioration of pavement. Control of trees and tall brush may be a necessity along utility lines. In other situations also there is good reason to control objectionable vegetation. If safe chemicals are the most effective and economical means of accomplishing this, it is only natural that they be used.

"Unfortunately, chemical control of roadside weeds and brush may under some conditions have detrimental effects on wildlife. The danger is not in the toxicity of these materials to birds, mammals and fish since, for the most part, this is minor. Rather it lies in the indirect influence they may exert on wildlife by destroying valuable food and cover plants and reducing the carrying capacity of an area. In this regard we recognize that 'weed killers' are not intrinsically harmful; in fact, they are now being employed by biologists as effective new tools to provide more favorable food and cover conditions for wildlife. The hazard, as we view it, exists in the manner of use.

"In intensively farmed areas or on land with few trees or shrubs, the brush along roadsides and similar "edge" habitats may provide the principal protective cover for rabbits, quail, pheasants, and other wildlife. Where it is probable that weed and brush control will drastically reduce essential wildlife cover, we feel that control operations should be modified, if possible, to preserve such habitat. In general, this means the utilization of selective spraying practices since blanket spraying often destroys beneficial as well as noxious plants. Through spot-spraying, weeds, trees and tall shrubs can be selectively eliminated. Clumps of low-growing, woody vegetation useful for wildlife cover and food and not detrimental to agricultural interests should be left. These plants will tend to resist further invasion by weeds and trees and will not interfere with roadside safety or endanger utility lines. At the same time, they will assist measurably in enhancing the natural beauty of the roadside—a principle that is now incorporated in parkway construction. Shrubby growth along roads also has additional value in lessening wind erosion and there is evidence to show that it supports fewer harmful rodents and insects than comparable areas in grass.

"Selective spraying generally is said to be more expensive than blanket spraying. In initial applications this is true but studies by Egler of the American Museum of Natural History indicate that maintenance costs and overall costs may be less. Blanket spraying must be repeated every few years, while under a selective spraying program, shrubby growth gains site dominance and only minor attention needs to be devoted toward invading weeds or trees.

"Many problems in roadside weed and brush control can be resolved by conferences between state wildlife authorities and those responsible for highway right-of-way maintenance. There are undoubtedly situations where the cover needs of wildlife cannot be reconciled with safety and maintenance requirements of highways. The reverse is true in many cases and we urge that, where control is necessary, an integrated program involving selective rather than indiscriminate blanket treatment be advocated."

● **ROADSIDE growth shown here includes a large amount of poison ivy. Results in eradicating this weed with chemicals have encouraged spraying in other locations.**

● **PUMPING STATION with automatic controls and standby equipment are located beneath this heavy concrete platform.**

Automatic Pumping Cuts Water Costs

PHIL HIRSCH

FOUR years ago, Park Ridge, Ill., about 15 miles northwest of Chicago, spent $350,000 to modernize its underground pumping station. The money purchased two new pumps and an electric control system which automatically matches pumping capacity to the fluctuating demand for water.

The new pumps almost tripled the capacity of the village's plant. Before the modernization, it was possible to pump no more than 4.25 million gallons of water per day. Today, the figure is about 11.2 million gallons per day, according to City Manager James L. Galloway. This is enough to supply a community of 65,000. Since the population of Park Ridge has increased 6,000 in the past three years, from 16,500 to about 22,500 the investment was obviously a wise one.

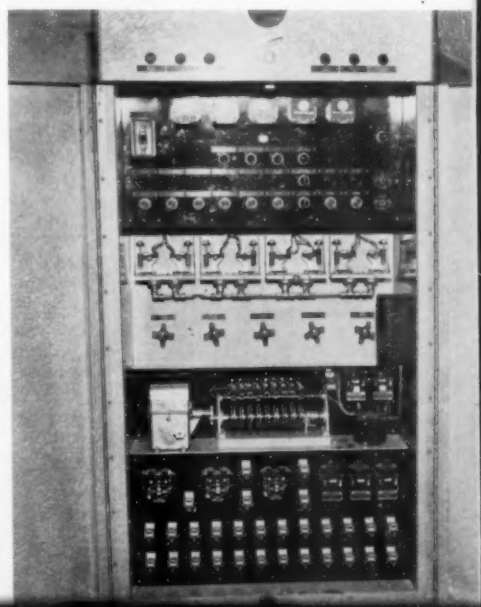
It was doubly wise because of the savings produced in operating expenses. When the plant was manually operated, it was necessary to employ four men. Each stood an eight-hour watch in the underground pump house. The fourth man was employed when one of the other three had a day off, once a week.

The salaries of this four-man crew totalled about $800 a month. Now, with automatic, instead of manual operation of the pumps, this expense has been eliminated. Instead, the city employs an electrician, part-time, at $50 a month, to maintain the electrical control system. It is also necessary to change, on a daily basis, the sheets on various meters which record water pressure, flow, and consumption in the system, but this job is handled by personnel in the water department in addition to their regular work, at no extra cost to the taxpayers.

The heart of the electric control system is a cabinet about six feet tall in the pump house which is filled with relays. These relays are connected to three Goulds pumps with a capacity of 2.27, 3.5, and 5.47 million gallons a day respectively. The relays are actuated by pressure valves in the mains which "report" fluctuations in the demand for water. As demand increases and pressure decreases, for example, the relays build pressure up again by switching in a pump of higher capacity.

The control board also regulates the amount of water flowing into the mains from a 12-inch line and a 24-inch line that brings it to the Chicago suburb from Lake Michigan. Before entering the Park Ridge mains, the water from these two lines flows into one of two reservoirs, adjacent to the pumphouse, which are also underground. One reservoir has a capacity of 750,000 gallons, the other of 1,250,000 gallons.

Both reservoirs are metered. Also, there is a gate valve which controls the flow into the reservoirs. The control board is hooked up in such a way that, automatically, when the water level in either reservoir has dropped to a predetermined depth, relays inside the board open the gate valve and allow more water to flow in from the 12- and 24-inch supply lines. And when the reser-



● **HEART of the automatic pumping station is this control board. Four operators were replaced by this equipment.**

voirs are full again, the gate valve closes automatically.

In addition to regulating water intake and outgo, the control board is equipped to cope with emergencies. If a relay fails to work, if there is an interruption in the flow of water through the two supply lines, or if pressure in the mains for any reason becomes too high or too low, a warning bell rings in the police department nearby, and water department personnel are summoned to find the cause of the trouble.

The Park Ridge water system includes a Caterpillar diesel-electric set with a capacity of 75 KW. In case of a power failure, this engine is turned on manually. Besides supplying power for the smallest of the three pumps, it energizes circuits in the police and fire stations, and keeps lights on in the pumphouse.

Since the pumping station and the reservoirs are already underground, the control board and the standby power source give Park Ridge a water system with more built-in protection against wartime emergency than is available in most other communities. This is especially true in view of the fact that the pumping station is built underneath a heavy concrete platform, used for flag-raising ceremonies and similar community events.

The control board maintains a pressure in the mains of from 44 to 62 pounds psi. Water consumption in Park Ridge varies, on an average day, from a low of 83,000 gallons per hour between 1 AM and 5 AM to 200,000 gallons per hour from about 7 PM to 11 PM.

The control board provides five different levels of pumping capacity to accommodate this fluctuating demand. The first level involves use of the smallest pump, and provides 2.27 million gallons per day. The 3.5 mgd pump is used alone for second level operations, and is usually enough to handle the average daytime load. Level three calls for use of the 5.47 mgd pump alone. This capacity is ample at all times except during peak summer conditions and excessive firefighting loads. Level number four is a combination of levels one and three, and provides a total capacity of about 7.75 million gallons per day. The fifth level, with an 11.2 mgd capacity, utilizes all three pumps. These last two steps, however, are rarely needed. They were installed mainly for future needs and extreme emergencies.

One of the novel features of the control system is that the transition from one stage to the other is made gradually. That is, when the load is being transferred from one pump to another with a higher capacity, the first one stays on until the second is warmed up. A time-delay relay accomplishes this task. As a result, there are no fluctuations in main pressure when the changeover takes place.

Time delay relays are also located in the control board circuit that operates the gate valve. The object here is to prevent water from surging into the reservoir, which would happen if the board was unable to open the gate valve gradually. With the aid of time-delay relays, the gate valve is opened a few inches every five minutes. It takes about five seconds for the board to move the valve from one position to the other. During the pauses, the time delay relays, in effect, lock the gate valve in a series of partially-open positions and avoid water surges.

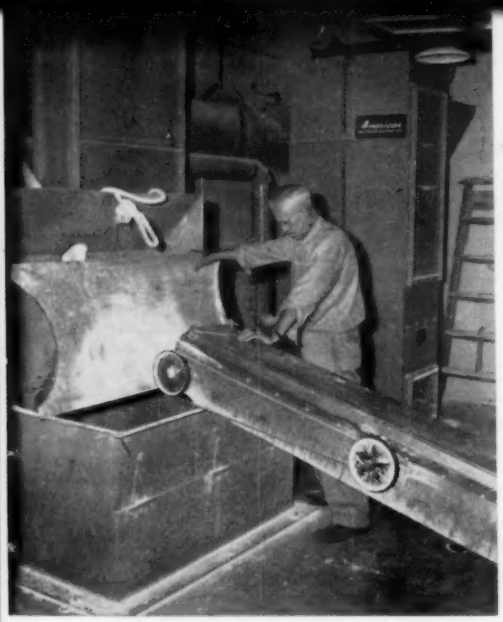
The control board and the meters which operate it were manufactured by the Automatic Control Co., St. Paul, Minn. Meter readings are converted into the electrical impulses needed to feed the control board by a system of mercury tubes, riding on a cam device. Changes in the level of the reservoir, for example, are reflected by movement of the cam. As the cam moves, it lowers or raises the mercury tubes, which carry electric current. When the cams move to a given position, the tubes close various circuits. These circuits, in turn, operate the relays hooked up to the gate valve. A similar system permits changes in main pressure to actuate the pumps.

DUST CONTROL

KEEPS WATER WORKS PLANT CLEAN

BY MEANS of dust control equipment, the municipal water works at Bucyrus, Ohio, has eliminated a serious dust condition that formerly resulted from the handling and batching of various chemicals in the water softening department. The materials involved are lime, alum, and soda ash. Since the alum and soda ash are delivered to the plant in bags, these chemicals became bothersome from a dust-producing standpoint only during the batching operation. But the lime is delivered in bulk by truck, so there is conveying, dumping, and elevating to be done with it to get it into storage.

All of these powdery materials are characterized by very fine particle sizes. Almost any agitation at all disperses them to the atmosphere. The original water works building which served this community for many years was without dust control equipment. It was at times hard to see in it. When the new four-story municipal plant was to be constructed, dust control was justified on the basis of several premises. First, the working lives of the various pieces of equipment in the plant would be increased Maintenance would be reduced Motors, instrument control panels, etc., all have their efficiencies and useful lives affected by dust. Second, dust control is a protection to plant operators, even though the dust of



● **DUST from conveyor delivery of truckload shipment of lime is picked up by dust collector in background.**

these particular chemicals is not poisonous. A third factor was that chemicals then being lost to the atmosphere as dust could be reclaimed for use in the softening operations. Dry chemicals were to be handled on the first, third, and fourth floors of the new plant, so a great deal of dust would be generated.

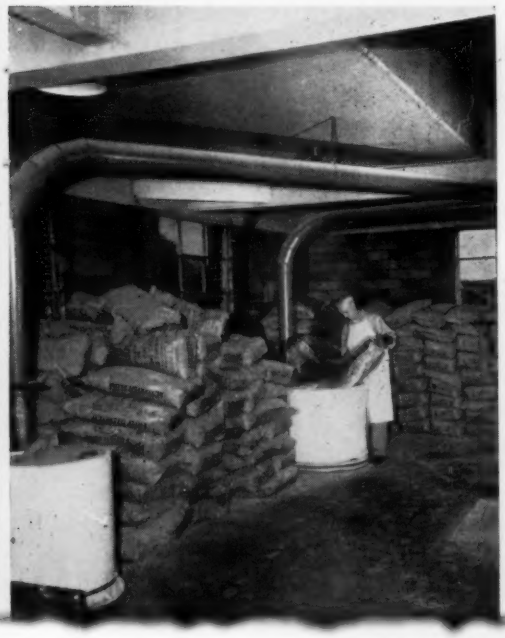
Local Exhaust Ventilation

A system of local exhaust ventilation was selected to handle the problem. This system consists of hooding at the various dust producing stations and ducts which transport dusty air from the hoods to the collectors. The hoods are designed to have air passing through them at a rather high velocity. This velocity is sufficient to overcome that of the ambient air currents tending to disperse the dust into the rooms. In this way, the dust is collected and trapped before it ever gets a chance to escape.

Because so much of the dust is made up of very small particles, the cloth-tube type of collector was chosen. Cloth filtration is capable of trapping the smallest particles with better than 99 percent efficiency. Cotton cloth was selected for the filter tubes by engineers of American Wheelabrator & Equipment Corp. The company, in manufacturing the collectors, based the choice on a consideration of air temperature, the corrosive and chemical properties of the dust, the normal particle sizes, the abrasive qualities of it, and a number of other factors determining the kind of cloth needed for satisfactory operation.

Photos courtesy American Wheelabrator & Equipment Corp.

● **BATCHING soda ash from bags into hopper creates dust, so hopper is ventilated**



● **VENTILATION system of the alum batching hoppers in the softening department of the Bucyrus, Ohio, plant.**

One Collector for Lime

On the first floor of the plant is a hopper to receive the 45-ton load of bulk lime brought in by truck. This quantity is received every six weeks. An enclosed portable belt conveyor is put into place, and it carries the lime from the truck into the receiving hopper. An elevator then takes the chemical from the hopper, carries it up three stories, and discharges it into the top of the storage bin. One Wheelabrator Dustube dust collector ventilates this hopper and elevator. It collects about 50 pounds of dust during the transfer of lime into the plant.

A second collector is located on the third floor where batching of the alum and soda ash into the water stream is done. Two hoppers are located there, one for batching each chemical. Each is ventilated into this second collector, which also receives a duct from the top of the lime storage bin on the fourth floor. A screw conveyor there distributes the elevated lime over the entire length of the bin to utilize all the storage space. This operation produces quite a bit of dust. Since this collector ventilates more stations than the other, it gathers more dust than the other. It receives about 300 pounds of lime from the 45-ton load at the time it is transferred into the bin, plus an undetermined amount from the half ton of soda ash and alum batched each day.

The material caught by both collectors is reclaimed and used in the softening process. For instance, the material trapped in the third floor collector is removed from it at the rate of 100 pounds a week, and charged right into the alum hopper.

Experience in operating the water works has proved the cost of the dust arrestors worth while. All of the problems formerly encountered due to dust are eliminated, and the building is maintained in a clean and neat condition.

A CAPSULE COURSE

HERBERT R. PERKINSON, JR.

Associate Traffic

and Planning Engineer,

Virginia Department of Highways

SIGNS

—Their Use and Placement

BECAUSE OF generally increased operating speeds and complex intersections, it is essential that the various types of signs be uniform as to shape, color, and wording. The matters of size and reflectorization are dependent upon the type of highway facility being signed and the revenues available. All signs should be designed and erected with the realization that to be effective they must be easily recognized and understood at a glance.

The *Manual of Uniform Traffic Control Devices*, published by the Bureau of Public Roads (Washington 25, D.C.), divides signs into three general classes: REGULATORY WARNING and GUIDE. Regulatory signs, excepting the STOP and YIELD signs, are rectangular in shape and have a white background; warning signs are diamond-shaped and have a yellow background; and guide or informational signs are horizontal rectangles and are generally combinations of white and black, although other color combinations are being tried. The two exceptions to the regulatory sign shapes are the STOP sign, of octangular shape, often having a red background, and the YIELD sign, of triangular shape.

The standards developed have been given much thought and for the vast majority of cases it is suggested that all signs conform to those recommended in the uniform manual. It is also a good rule of thumb that warning and regulatory signs be held to a minimum, while use of guide and informational signs can be more liberal. The reasoning behind this procedure is to avoid crying "wolf!" when there is no real danger, in the case of warning signs, but at the same time clearly and dis-

DURING THE past year, the roads and streets of the United States carried a record shattering 550 billion vehicle miles of traffic. Despite numerous studies by "the experts", the expected leveling off of traffic volumes has not arrived, nor is any appreciable decline in traffic in sight. We constantly hear of plans for multi-million dollar expressways, elaborate parking facilities, greater use of mass transportation and so on. We are reminded that our vehicle registration has doubled since 1937, and that if we are to retain some measure of our accustomed freedom of movement on our streets and highways, all (particularly public servants) must work hard with the tools available to assist in the solving of this complex problem.

With this flood of traffic facing us, it is obvious that every County, City and Town Engineer must also be something of a traffic engineer. A majority of the larger cities, and the more heavily populated counties, are now well staffed by qualified traffic engineers. However, sound traffic practices should begin at the grass roots level, and the smaller communities, whether counties or towns, have not yet found it feasible to employ such specialists.

This article is directed towards the technical officials of the latter group in the hope of conveying a better understanding of the use of the tools available, and of practices now recognized as standard. The tools available to the average small governing group are signs, signals, pavement markings and inexpensive channelizations. For simplicity, these groupings will be discussed separately.

in TRAFFIC CONTROL

FOR CITY AND COUNTY ENGINEERS

tinctly to point up the real problems. Informational signs are primarily to help the stranger and seldom, if ever, are there complaints that destinations or directions are oversigned.

The matter of sign placement is very important from both the functional and maintenance standpoints. Although standardization of position cannot always be attained in practice, signs are to be located on the right-hand side of the roadway whenever possible. Signs in any other position should ordinarily be considered only as supplementary to signs in the normal location. Under some circumstances, signs may be advantageously placed on channelizing islands, overhead, or (as on sharp curves to the right) on the left-hand shoulder of the road, directly in front of approaching vehicles. In such cases, the supplementary signs should be definitely more conspicuous than the signs normally used. A supplementary sign located on the left of the roadway is often helpful on a three or four-lane road, or on a one-way road, where traffic in the right-hand lane interferes with the driver's view to the right.

All signs should be mounted approximately at right angles to and facing the traffic that they are intended to serve.

Reflectorized signs should usually be turned a little toward the road to keep the incident angle of the headlight beams near 90 degrees throughout the range of useful visibility. Where mirror reflection from the sign face is encountered in such degree as to reduce the legibility of the signs, both non-reflectorized signs and those reflectorized with buttons should be turned slightly away from the road. At curved alignments, the angle of placement should be determined by the course of approaching traffic, rather than by the roadway edge at the point where the sign is located. On grades, it may be desirable to tilt a sign

● **OVERSIZE informational sign for truckers placed in advance of a long descending grade. Contrasting foliage background at this location gives excellent visibility.**

● **A WELL PLACED advance junction assembly on a heavily traveled highway. Units are reflectorized with buttons and have good color contrast for day-time driving.**

● **STANDARD speed limit sign set well behind the ditch line away from road spray and shoulder maintenance.**

forward or back from the vertical, to improve the viewing angle.

Advance warning and junction type signs are usually placed from 350 ft. to 500 ft. from the specific condition referred to. Assuming these signs are visible to the driver for an additional 200 to 300 ft., ample warning is afforded the traveler driving at the usual 50-60 MPH operating speeds. Naturally, these advance distances should be varied to conform to the highway geometrics, as greater distances will certainly be required on express highways, or other high speed arteries. In towns and urban areas, distances of 250 to 300 ft. are normally adequate.

For the average two-lane road, signs on the road shoulder should be not less than 6 ft. nor more than 10 ft. from the pavement edge. On highways having wide shoulders and rights of way, it is good practice to place the signs back of the ditch line. When this is done, it simplifies mowing operations and decreases the probability of vandalism, particularly where there is pedestrian traffic.

In urban areas, where raised curbs are present, signs should be placed adjacent to the roadway, with the nearest edge at least one foot back of the curb line.

On rural highways, shoulder signs should be mounted at a height of 4 feet above the crown of the pavement to the bottom of the sign, except on multi-lane facilities. On these, a minimum distance of 6 ft. should be obtained to enable motorists to see the signs when passing other moving vehicles. All signs in urban areas, should be mounted at least 7 ft. to the bottom of the sign so as to be visible above curb parked vehicles, and provide a minimum interference with pedestrian movements.

Sign maintenance has become less and less difficult with the development of new materials. Damaged signs should be replaced or repaired immediately. All signs should be cleaned when their message becomes clouded with road spray. A solution of commercial bleach or cleaning compound and water is adequate. A common failing in summer is to permit weeds, foliage of small trees, etc., to obscure the sign or message. A sign in this condition is, of course, worthless.

Overhead signs, whether in rural or urban areas, should be mounted at a height of not less than 15 ft. above the road surface.

The engineer must remember that with all the rules regarding sign placement plenty of good common sense must be used by the sign foreman. One incident immediately comes to mind. A sketch was sent to a signing foreman showing in some detail the layout arrangement of the signs for a new intersection, and to give the foreman an approximate idea of the specific sign locations, distances in feet were indicated. Later an inspection was made of the job, and it was noted that the most important sign assembly was situated directly behind, and within 6 inches of, a utility pole. When questioned, the foreman replied that the sketch indicated that particular sign to be placed 350 ft. from the center of the intersecting road, and that is exactly where it was placed.

Care should also be taken to avoid the bunching of different types of signs. With the various types of regulatory and informational signs required at the boundaries of the various political sub-divisions, this is sometimes difficult to accomplish. However, a number of these signs contain information that would apply a half mile or so down the road, and well spaced signs naturally are more effective.

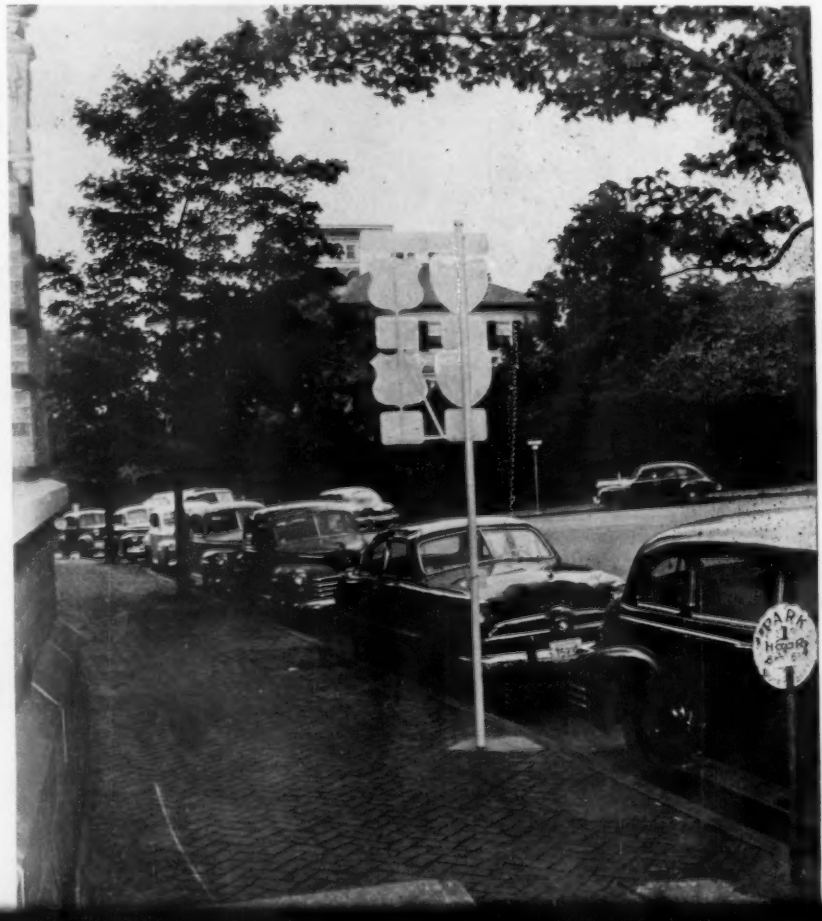
It is, of course, desirable that all signs which apply equally during hours of darkness as well as daylight be reflectorized. Accordingly, the highest degree of reflectivity possible should be obtained on important through highways. On light volume and lower classification roads, less expensive reflectorized materials may be used, and normally these signs will do the job adequately without upsetting the budget. It is very seldom that such signs as SCHOOL ZONE, CATTLE CROSSING and MEN WORKING for example, need be reflectorized.

Reflectorized signs are not generally completely effective for overhead sign installations. Since these installations are few in number and always represent special cases, some form of illumination is recommended in lieu of reflectorization. In cities, towns and other urban communities where street lighting is available, plain baked enamel signs are satisfactory.

The recently developed YIELD RIGHT OF WAY sign has eliminated the need of STOP signs at some locations, and MERGING TRAFFIC signs at others. Generally speaking, YIELD signs can be considered when:

(1) Existing STOP signs are not being observed and the average motorist can see no reason to come to a full stop.

(2) The motorist entering a main



● **URBAN junction assembly. This arrangement is set back from the curb and is visible over the parked cars.**

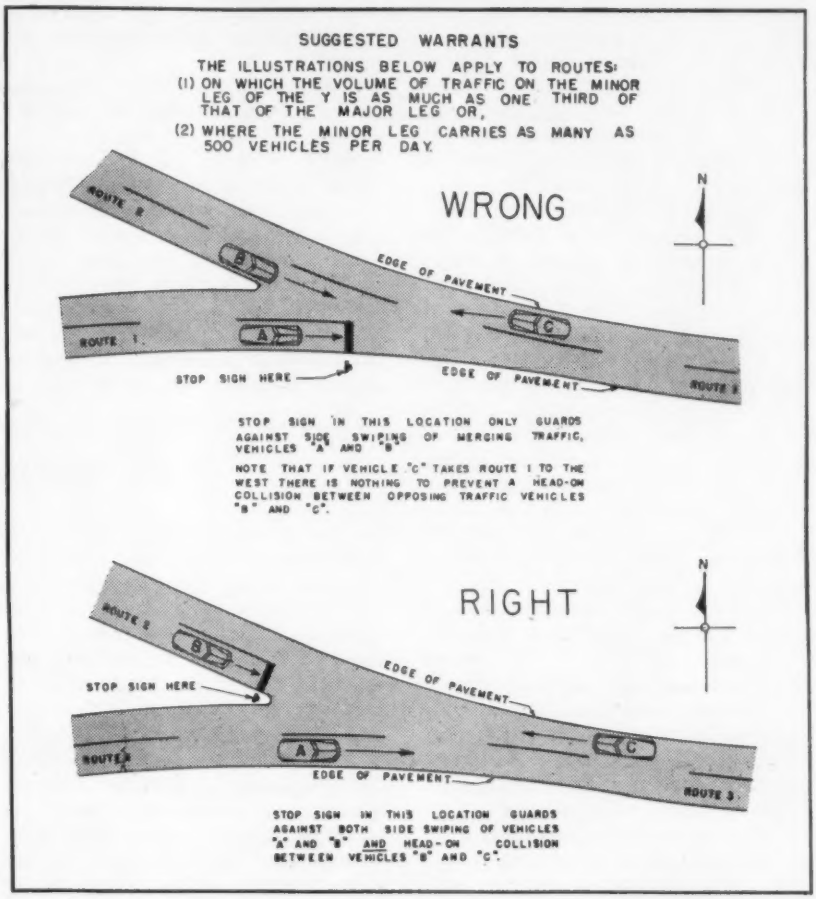
highway has sight distances of at least 800 ft. in both directions.

(3) Traffic volumes on the main highway are not too heavy. As a rough guide, YIELD signs should not be used where volumes on a 2-lane highway are over 4000 VPD, or over 8,000 VPD for four lanes.

There are many locations at which the presence of STOP signs are still essential. While the stop leg of the junction is usually the minor road, acute angle intersections present special problems. It is very important in these latter cases, especially on heavily traveled roads, that vehicles entering the interior angle of the junction be stopped so as to lessen the possibility of head-on collisions between opposing streams of traffic. The illustration herewith shows the right and wrong way of placing these signs, with suggested warrants.

The engineer is probably called upon to have SPEED LIMIT signs erected in more instances than all other types of signs combined. In these cases, it is well to remember that any zone established must be realistic and enforceable, and also that the mere presence of the sign will not automatically slow down the speeds of vehicles on a given road or street. When zones are established, a sufficient number of signs should be used adequately to inform the traveler of the proper limit, and the beginnings and endings of the zones definitely fixed by proper regulatory signs. Heavily developed sub-division streets can be signed economically by placing a single sign at each of the main entrances and omitting the intermediate sign installations. Some form of traffic investigation or survey should always be made before any regulatory zone is imposed on the public.

Maximum safe speed assemblies can be used at spot locations to provide effective and economical stop-gap treatments pending the relocation or superelevation of sharp curves. These assemblies consist of a standard curve or turn symbol with an advisory plate, stating the safe speed, mounted immediately thereunder. The safe speed can readily be determined by driving the curve in question several times from both directions, preferably in a car equipped with an inclinometer, or ball bank indicator. These instruments can be obtained at a very nominal cost and are readily mounted on the dash of any passenger car. A typical installation of a maximum safe speed assembly is shown herewith.


SUGGESTED WARRANTS
THE ILLUSTRATIONS BELOW APPLY TO ROUTES:
(1) ON WHICH THE VOLUME OF TRAFFIC ON THE MINOR LEG OF THE Y IS AS MUCH AS ONE THIRD OF THAT OF THE MAJOR LEG OR,
(2) WHERE THE MINOR LEG CARRIES AS MANY AS 500 VEHICLES PER DAY.
WRONG
N
ROUTE 2
ROUTE 1
ROUTE 3
EDGE OF PAVEMENT
STOP SIGN HERE
A
B
C
STOP SIGN IN THIS LOCATION ONLY GUARDS AGAINST SIDE SWIPING OF MERGING TRAFFIC, VEHICLES "A" AND "B".
NOTE THAT IF VEHICLE "C" TAKES ROUTE 1 TO THE WEST THERE IS NOTHING TO PREVENT A HEAD-ON COLLISION BETWEEN OPPOSING TRAFFIC VEHICLES "B" AND "C".
RIGHT
STOP SIGN IN THIS LOCATION GUARDS AGAINST BOTH SIDE SWIPING OF VEHICLES "A" AND "B" AND HEAD-ON COLLISION BETWEEN VEHICLES "B" AND "C".

● **TYPICAL locations for signs at acute angle junctions. Consideration must be given to accident prevention for all possible traffic movements. In this example the upper diagram illustrates the possibility of head-on collision between cars B and C, neither of which is regulated. Lower diagram illustrates better practice.**

● **MAXIMUM safe speed assembly combines graphic warning plate with an advisory plate. Safe speeds on curves can be determined easily by use of an inclinometer.**

Portable signs, used in conjunction with special markings, are often effective to provide better control of traffic in school zones, or in advance of school crossings. However, the effectiveness of these signs is commensurate with the manner in which they are placed daily—that is, they should be visible to traffic only for short periods while children are going to and from school, or playing on adjacent school grounds. If such signs are to be used, pedestal type mountings are preferable since they are easily rolled into place, and are less likely to be knocked over by passing vehicles. When street or road widths permit, they are most effective when used in the center of the pavement. These assemblies generally carry the wording SCHOOL or SCHOOL CROSSING on one plate, and an appropriate speed limit on the other.

Just a word about one-way streets. Traffic conditions can be materially improved in the more congested sections of many towns by the establishment of one-way routings. Almost always initial opposition will be encountered from merchants in the affected areas, and some motorists will complain that they have to travel greater distances to reach a given point. However, if congestion is serious, the advantages of such a system will far outweigh the disadvantages and after a reasonable trial period of the one-way operation, a vast majority of the citizens will be satisfied with the change. The more important advantages of one-way streets include their ability to carry greater volumes of traffic, reduce most types of accidents, facilitate the operation of progressive traffic signal systems and improve pedestrian movements. Since the overall traffic conditions are improved, and more vehicles can use a given facility each hour, it should be obvious that a large percentage of the adjacent business properties will be ultimately benefited instead of harmed.

In signing one-way streets, see that the markers are prominently placed on the near right-hand and far left-hand corners of the intersection, so as to face traffic entering or crossing the one-way street. Small plates advising of the regulation should also be placed beneath the signal at signalized intersections. It will also be necessary to place one-way signs opposite the exits from alleys, parking lots, and the like, to insure proper traffic movement.

PAVEMENT MARKINGS

IT IS INDEED unfortunate that pavement markings are not too well understood, for it is doubtful if money spent for any other highway activity pays greater dividends in terms of safety than that spent on the small white lines.

Pavement markings are lines, words, or symbols that are applied to the pavement surface to assist the motorist in driving conduct. These markings are very closely related to graphic signs, and under certain conditions they are preferable to signs in that they convey warnings or information to the driver without requiring him to divert his attention from the roadway surface.

The careful application of pavement markings can be very helpful in safeguarding and expediting traffic. Center and barrier lines tend to prevent head-on collisions at horizontal and vertical curves, and lane lines on wide pavements promote the orderly flow of traffic, thus increasing capacity.

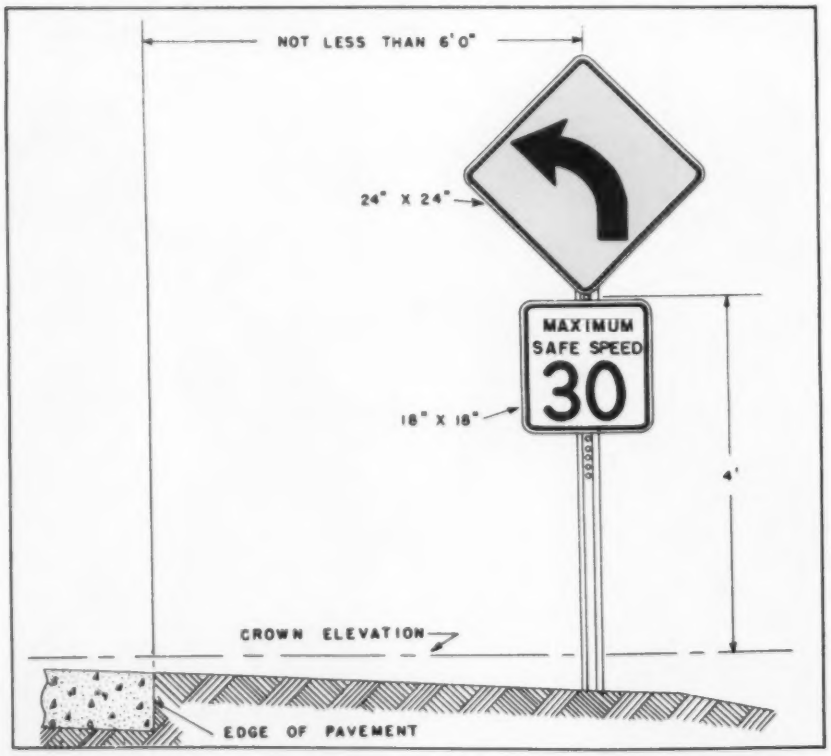
Markings also have certain limitations. They are entirely obliterated by snow, are not as visible when wet and are not too durable on some types of pavements.

Pavement lines are usually applied to all Primary or main highways having a pavement width of 18 feet or more, and at certain accident-prone locations on lower volume roads. The longitudinal lines are 4 inches in width with a 4-inch spacing between lines where double lines are used. White paint is used for all pavement marking, with the exception of the yellow lines frequently used for no-passing lines.

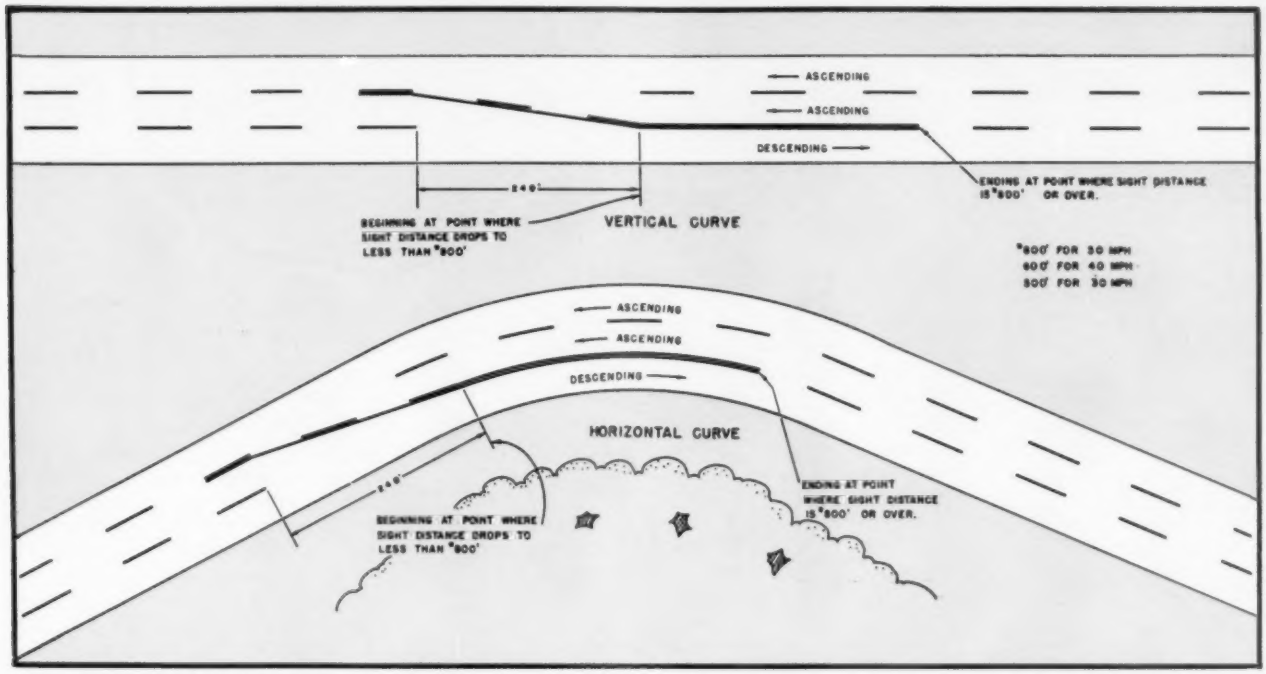
A majority of highway departments use a 15-foot painted section of line, with a 25-foot skip for center line markings. Barrier lines are solid, being placed next to the dashed lines on the side from which passing is prohibited.

Even more effective are reflectorized pavement markings, obtained by adding minute glass spheres to the painted line while it is still wet. Reflectorization is highly desirable in all markings and the overall cost is very reasonable. It is true that the initial expenditure is higher than for plain lines, but the increased life of the reflectorized lines more than compensates for the additional cost.

The frequency of repainting naturally depends upon the type of surface, composition of paint, rate



● **STANDARD warning signs showing height and lateral location of the elements. This particular type of installation is designed for use on rural highway curves.**


ASCENDING
ASCENDING
DESCENDING
ENDING AT POINT WHERE SIGHT DISTANCE IS "800' OR OVER.
BEGINNING AT POINT WHERE SIGHT DISTANCE DROPS TO LESS THAN "800'
VERTICAL CURVE
"800' FOR 30 MPH
800' FOR 40 MPH
800' FOR 50 MPH
ASCENDING
ASCENDING
DESCENDING
HORIZONTAL CURVE
ENDING AT POINT WHERE SIGHT DISTANCE IS "800' OR OVER.
BEGINNING AT POINT WHERE SIGHT DISTANCE DROPS TO LESS THAN "800'

● **PAVEMENT MARKINGS for use on three lane highways with sight distances restricted by vertical and horizontal curves.**

of application, climate and volume of traffic. On the average, traffic lines on roads carrying about 4000 vehicles per day last from 9 to 12 months. On very heavily traveled highways it may be necessary to repaint the markings three times per year. Particular care should be taken, especially in the case of broken lines, to paint over the old markings as nearly as possible, or they will appear increasingly ragged after successive repaintings.

If any appreciable mileage of center or lane lining is to be applied, it is essential that motorized equipment be used. Equipment has been developed that can place single, double, or even triple striping with any combinations of solid and broken lines while operating at speeds of 5 to 15 miles per hour. Hand equipment is generally used to place transverse markings, pavement arrows and lettering. An average of 5 to 18 gallons of paint per mile is needed to apply all normal markings on rural main highways.

Protecting the wet lines from traffic has always been one of the toughest problems of centerline work. Experience has indicated that heavy rubber Z-type guards painted yellow and spotted at each end of the broken stripe are very satisfactory. These markers are durable, store easily, and do not damage cars when struck accidentally by a vehicle. On high volume roads, it is essential that a police patrol officer be present during marking operations to aid in controlling traffic.

Pavement markings are well standardized for two, three and four-lane undivided highways where adequate sight distances prevail. No-passing zones are established by marking a solid barrier line in addition to a lane line at vertical or horizontal curves, or at other locations on two and three-lane highways where passing must be prohibited because of dangerously restricted sight distances or other hazardous conditions. In establishing the above zones, passing sight distances are defined as the distance at which an object 4½ feet above the pavement surface can just be seen from another point 4½ feet above the pavement—the eye level of the driver.

Accompanying sketches indicate the use of barrier, or no-passing, lines on a three-lane highway where sight distances are restricted by horizontal and vertical curves.

For the average rural highway having a design speed of 50 MPH and over, passing should not be permitted when the sight distance drops below 800 feet. On lower design roads this distance is decreased somewhat, but even at a 30-MPH road a 500-foot sight distance is considered necessary for safe passing maneuvers. On many bituminous treated roads, where resurfacings are frequent, it is a good idea to establish semi-permanent field markers on the slopes to insure correct repainting of the barrier limits.

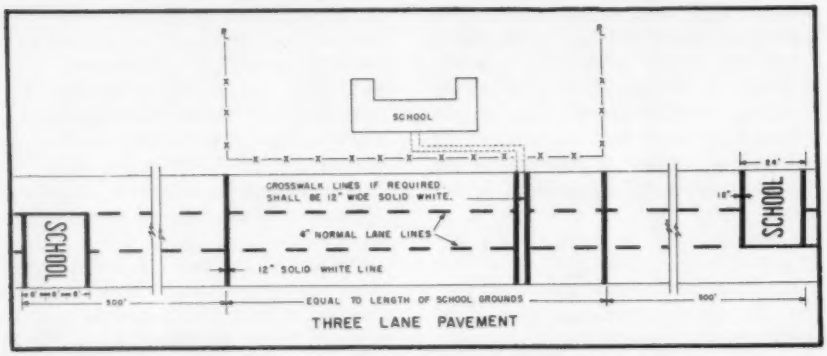
Breaks in pavement marking lines should be made at all important road intersections and should be of sufficient length to provide a suitable turning radius for vehicles leaving the main road. Anyone who has done much night driving has noticed how these breaks, particularly in reflectorized markings, have-pinpointed the exact spot for making turns from heavily traveled highways in the face of the glare of on-coming headlights.

Nevertheless, breaks for private road entrances and very slightly traveled public roads should not be allowed since too many gaps would seriously reduce the effectiveness of the center line markings.

Traffic movements through much-used county road junctions can be greatly facilitated through the use of pavement markings—and at small cost. The aerial photograph on the following page indicates a treatment applied to an irregular type junction using directional arrows, stop or limit lines and cross-hatching. Stop-gap measures such as these can be used advantageously as a proving ground for channelization design prior to the actual construction of the dividers and islands.

The stop lines, mentioned above, are solid lines 12 to 24 inches wide extending across the approach lanes to an intersection. They are used in both rural and urban areas where it is important to emphasize the point behind which vehicles are required to stop in accordance with a sign, signal or other legal requirement. Their use is almost mandatory at certain locations where it is not

● **PAVEMENT MARKINGS at an irregular county road intersection. Reflectorized lines were used to outline the island areas and to encourage correct lane useage.**



● **SCHOOL ZONES require special pavement markings. This example shows markings for three lanes. Two and four lane roads have generally similar arrangements.**

feasible to place a STOP sign at the exact point where vehicles are required to stop.

Special type markings are used in advance of main line railroad crossings and school zones on principal arteries. At the grade crossings the markings consist of a cross, the letters "RR", a barrier line and certain transverse lines. Naturally, this type of treatment would not be used at minor sidings, spurs or in urban areas where electric signals, mechanical gates or similar protection is afforded. The big advantage of these markings is that their distinctive appearance attracts the driver's attention to a specific condition. These markings are used in conjunction with standard warning signs. School markings (as indicated) are also used to supplement standard SCHOOL or SCHOOL ZONE signs, and more clearly define the limits of the building or grounds.

Another important use of pavement markings is the designation of separate lanes to segregate through vehicles from local or turning traffic. This is accomplished by painting the words LEFT (or RIGHT) TURN and THRU to the appropriate lanes, sometimes in addition to directional arrows on the approaches to intersections. This method of marking is very helpful on abrupt changes of directions for main routes through towns and cities, where conventional signs are often obscured by trucks and the out-of-town motorist often confused by traffic and conditions in general. Route numbers with appropriate advance arrows are also extremely effective when applied to the pavement surface in the above cases.

In towns and villages, major streets having generally not less than 22 feet of travelable width at all times free of parked vehicles are marked with standard stripe and skip center lines. In addition, cross-walk and parking lane lines for parallel parking are used wherever required and approved by the governing authorities. However, parking lane lines should be permitted only on streets where the curb to curb width is 29 feet or more and where all angle parking is prohibited. Parallel parking should be permitted on one side only on streets from 29 to 35 feet in width and on both sides when the width is 36 feet or more.

Parking lane lines normally consist of a solid four-inch line placed 7 feet from the curb line and broken only at prohibited areas provided for entrances, alleys, fire hydrants, bus stops and the like. Transverse cross lines between the parking lane line and the curb are painted at the beginning and ending of the parking lanes. Where meters are present, and to increase the efficiency of the curb spaces, the limits of each stall are also marked by transverse lines.

Cross-walk lines should be applied where pedestrian volumes are substantial, using lines from 6 to 8 inches in width. It is desirable that the width of the walk be equal to the adjoining sidewalk, but in no case should it be more than 12 or less than 5 feet. Center or parking lines should not pass through cross-walk areas when these areas are appropriately marked.

Other markings are also helpful to point up those places where parking is prohibited at all times. Where used they should be of solid yellow color and cover the face and top of the curb.

While highway markings are often thought of solely as lines or messages applied to the pavement surface, physical obstructions in or near a roadway which constitute hazards or potential hazards should also be adequately marked. Typical obstructions of this nature are bridge piers and abutments of overhead structures, culvert headwalls and bridge railings, ends of medial dividers and traffic islands, trees, large rocks and other fixed objects. Since capacity studies have shown that traffic flow is not adversely affected by clear shoulder widths of 6 feet or more, obstruction markings normally need to be considered only when the hazard is less than 6 feet from the pavement edge. Standardization of these markings, as in the case of signs, is desirable at all times in order to provide a consistent means of traffic control and warning for the motoring public.

These obstructions are marked with not less than five alternating

uniform black and white stripes, with the stripes sloping downward at an angle of 45 degrees toward the side of the obstruction on which traffic passes. The width of the stripes should be such to insure a good appearance and to provide sufficient visibility from approaching vehicles.

For objects which do not lend themselves readily to repainting, or narrow obstructions such as bridge railings, stripings placed on marine plywood or some other independent surface are very effective. The bridge end boards shown in the accompanying photograph are excellent examples of the added visibility that can be attained.

At obstructions lying directly in the line of traffic, or where accident rates are unusually high, some type of illumination should be used in addition to the markings. Several very bad locations at narrow underpasses are recalled where flood lighting was used at a minor cost virtually to eliminate serious accidents. Where such lights are used, care must be taken to avoid throwing a glare in the face of drivers approaching from either direction. At times it is desirable to place the illumination behind the underpass from approaching traffic so as to silhouette the roadway completely.

The noses of the curbs of all islands located in the line of traffic should be painted with yellow paint. It is also good practice to paint the curbs of certain narrow bridges with white reflectorized paint to provide better delineation.

● **SIGNALIZED rural intersection on a high speed divided highway has separate signals housings for each pavement. An auxiliary signal with a green right turn arrow is shown in the channelizing island at the right hand side of the highway.**

Road edge delineators, consisting of wooden or metal posts, with one, two or three reflecting crystals, are used to supplement pavement markings on rather narrow shoulders along high unprotected fills or deep drainage ditches. These posts are also advantageous to complement standard signing by outlining sharp curves and turns. Delineator posts can further be used to mark culvert headwalls and culvert ends that lie within the shoulders of the road, and transitions in pavement widths. These units are a very definite aid to night-time driving and in outlining roadways subject to minor flooding.

Again it should be emphasized that in traffic work there is no substitute for a heavy hand with the paint brush.

● **STANDARD markings for four lane pavement. Note use of bridge end obstruction markings by the bridge rails.**

TRAFFIC SIGNALS

EVER SINCE the first traffic signals began blossoming out all over the nation in the early 20's, they have been recognized as one of the more valuable devices for the control and safe facilitation of vehicle and pedestrian traffic. As they assign the right of way to traffic at intersections and at other locations on our streets and highways to the advantage or disadvantage of the vehicles or pedestrians controlled, it is obvious that signal installations should be made only after thorough study. Once a signal is in operation, occasional checkbacks should be made to see that it is best serving the demands of traffic.

All of us would readily agree that signal installations are necessary to prevent chaos (unorganized, that is) at the main grade intersections in our metropolitan areas. Admitting that serious traffic congestion exists in just about all of our urban areas, consider what it would be like to try to negotiate the downtown sections of New York City, Chicago or San Francisco if there were no signal controls.

Traffic signals which are justified and properly operated usually have at least one of the following advantages:

1. Provide for more orderly traffic movement.

● **PROPERLY placed markings on urban streets are a tremendous help in obtaining more orderly traffic flow.**

2. Reduce the frequency of *certain types of* accidents.

3. When coordinated, provide continuous or nearly continuous traffic movement at a set speed over a given route.

4. Control speeds on certain through highways and main streets.

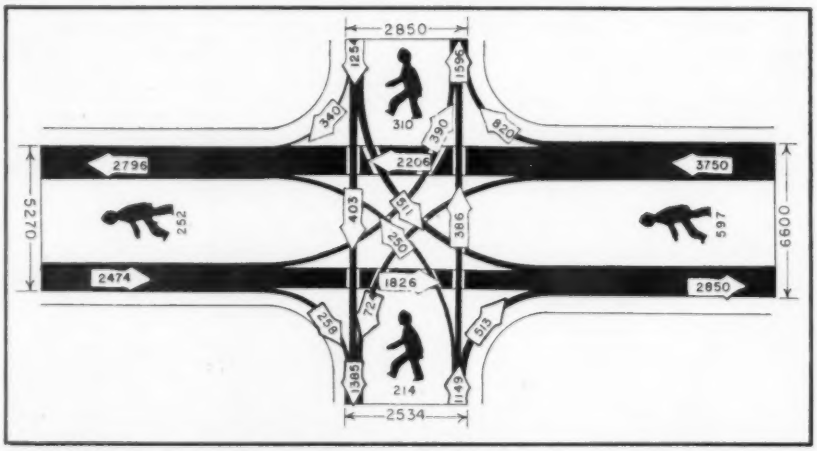
5. Interrupt heavy traffic to allow lighter side movements to cross or enter the main flow.

6. Offer considerable economy over manual control at specific locations.

Unfortunately, however, the general public has come to regard the traffic signal as a panacea for all intersection ills known to man. In many cases civic groups, governing bodies or individuals have traffic safety problems which they are certain can be solved only by the installation of a signal. This thinking has led to the erection of traffic signals at a large number of locations where volumes do not warrant an installation and where simple signs and markings would have provided a better and more economical solution. Further, even where sufficient traffic volumes exist, signal control systems have been erected that are improperly designed, poorly placed and incorrectly operated. Unwarranted or improper signals not only can cause excessive delay, general disregard of signal installations and use of alternate routes, but they frequently increase the accident experience. For example, if a signal were erected at an intersection where a number of right-angle collisions were reported and cross traffic was not too heavy, it is probable that the pattern of accidents would shift to a comparable number of rear-end type collisions, with an occasional right-angle or turning type collision. The contention that unwarranted signals can cause increases in the accident rate is supported by a study made several years ago by a State Highway Department. About a dozen locations were checked where signals had been installed prior to the adoption of complete signal warrants. While traffic volumes had increased about 20 percent between the "before" and "after" study periods, the number of accidents increased 50 percent, number of persons killed 28 percent, and number injured 65 percent after signal installation.

In considering the relationship of traffic signals and accidents, it is well to remember the specific types of accidents that are not often corrected by signalization. Naturally, rear-end collisions, or those between vehicles when one is making a turn, are not prevented. Nor are accidents involving pedestrians and turning vehicles moving on the same "green" indication.

As continuing improvements to the motor vehicle increases the range of traffic circulation, it is all the more important that national standardization of signals be obtained. The design and specifications of the signal units is completely covered in the *Uniform Manual* mentioned earlier in this article. Briefly, all signal faces should have at least three lenses—red, yellow and green, in that order, from top to bottom. Arrows for various turns or pedestrian indications are added vertically beneath the green indication. The individual lenses should be circular, with a visible diameter of at least eight inches, and each lens should be illuminated independently of any other lens. In urban areas, the bottom of the housing of the signal face should not be less than 8 nor more than 10 feet above the sidewalk. Where the housing is suspended above the roadway, as on rural highways, the height to the bottom of the housing should be from 14½ to 15½ feet above the pavement surface.



● **A TYPICAL 24-hour turning movement diagram shows vehicle and pedestrian volumes in each direction. These data assist in planning traffic signal installations.**

The above discussion of improper uses of signals is not intended to discourage their installation. The matter is dwelt on at some length merely because next to the operation of speed traps, no single condition that the motorist encounters is more irritating than the arbitrary placement of signals that are not necessary. Just remember that a traffic signal, as such, is not a safety device. In fact, it is no more than a regulatory valve to maintain the orderly flow of traffic. Often traffic safety is the result of obtaining a more orderly traffic flow, but order and not safety is the functional purpose of a vast majority of signalization projects.

Highway traffic control signals are divided into two major classifications: (1) fixed-time signals and (2) traffic-actuated signals. Other types of signals include special pedestrian signals, flashing beacons, lane-direction signals, drawbridge signals and flashing lights and wigwags for railroad grade crossings. In purchasing traffic control equipment, it is important to keep the future in mind. Flexible equipment may not be considered necessary initially, but it may prove highly desirable within the life of the installation and will almost always be more satisfactory and economical in the long run.

Since nearly all traffic signals are

of the fixed-time or traffic actuated types, it might be well to discuss briefly the characteristics of each. With fixed-time signals, traffic is controlled by red and green indications based on a predetermined time schedule. This sequence is consistent and regularly repeated. The cycle length, or time required for one complete sequence of signal indications, generally can be set from a minimum of 30 seconds to a maximum of 120 seconds. The selection of a cycle length and the "split"—percentages of time the major and minor arteries will have green indications—are determined by the traffic demands of the intersecting streets. Once the cycle length and the split have been established, the signal will continue in operation following the set sequence until the timing schedule is adjusted manually or by additional automatic equipment.

When traffic-actuated controls are used, the cycle lengths are not fixed but are varied to conform best to the demands of traffic automatically. Thus the red and green indications are normally self-adjusting within certain minimum and maximum time limits. Obviously, the actuated type of equipment is often more flexible than the fixed-time, and a number of operating variations are used. Two of the more common are semi-actuated and full-actuated control.

In semi-actuated traffic control, the green signal or right-of-way is usually given to the main stem unless a "call" or actuation is received from the side street, at which time the right-of-way will be switched to the minor road. After the green indication has been retained on the side road for a very short period, it automatically returns to the main artery to remain until there are other approaching vehicles from the side street. More complicated intersections often require the use of full-actuated control in order to permit higher operating efficiency. With full traffic-actuated signals, approaching vehicles on all legs of the intersection determine the assignment of right-of-way.

Both the fixed-time signal and the traffic-actuated signal have a very definite place in solving today's traffic problems. However, the strong points of each type signal are:

Fixed-Time: 1. Simplicity of equipment, with very little maintenance and servicing needed; 2. Easily interconnected with other fixed-time signals to provide positive speed control and progressive movement on long sections of urban streets; and, 3. Serves traffic very adequately at many junctions at low cost.

Traffic-Actuated: 1. Since delay and inconvenience are lessened, greater intersection capacity can be attained; 2. Very effective at multiple intersections, problem intersections, or where approaching traffic varies considerably on different legs, following no set pattern; 3. Probably reduce the accident potential during off-peak hours when very few vehicles are using junctions; and 4. May minimize the tendency to avoid signalized intersections, and thereby result in the use of more logical routings.

A complete set of warrants have been approved as standard by a joint committee of the AASHO, Institute of Traffic Engineers and the National Conference of Street and Highway Safety; these are also contained in the *Uniform Traffic Manual*. Before erecting any traffic signal a study should be made to obtain certain facts. The engineer should determine the traffic volumes, including directional movements through the intersection for the most heavily traveled 8 hours of an average day. Pedestrian movements, speeds and vehicle classifications, and an accident summary for the past year or more should also be obtained. Finally, the physical layout of the intersection should be considered with respect to roadway widths, sight distances, parking practices, bus stops and railroad grade crossings, if any.

Once the above data have been studied, the engineer can readily consult the various warrants to determine if the installation of a traffic signal would help the particular problem, or is really needed. For example, the *minimum* vehicular warrant states that for urban areas an average of at least 750 vehicles must *enter* the intersection from all approaches for any 8 hours of an average day, with at least one-fourth or 175 of these vehicles entering from the minor street. For rural areas, the minimum volumes are 500 and 125 vehicles respectively. A sample turning movement diagram is shown to clarify the use of the vehicular warrant. Similar warrants have been set up to cover interruption of continuous traffic, heavy pedestrian volumes, coordinated movement, accident hazards, and other factors.

In addition to using the above warrants as a guide, be sure to use some plain common sense in erecting the signal once it is believed justified. Many accidents are caused because the visibility of the signal is poor. This can be overcome by providing background boards or auxiliary signal faces in addition to painting the housing a bright yellow. Also be careful to shield the lenses at multiple junctions so that the driver will be confronted with only one indication.

At rural locations, or wherever approach speeds are high, see that ample advance notice is given—maybe by flashers over the warning signs, overhead or oversize

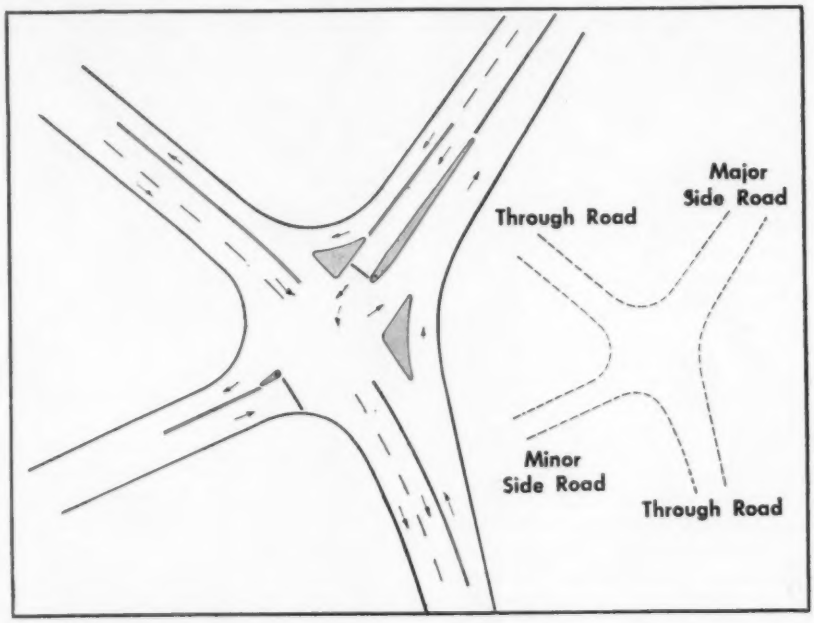
● **OVERSIZE red lenses command driver attention. They have been installed experimentally on this main arterial junction in an effort to lower the accident rate.**

signs or pavement messages. In this connection, oversize signal faces are being tried out and these apparently will prove very effective at problem locations. As accident rates are nearly always high at these locations when there are narrow type medians, if at all possible try to provide for a recessed left-turn lane through the junction to permit shadowing of turning vehicles. These lanes can be added at reasonable cost wherever a median width of 16 feet is available.

It is poor practice to permit turns on red signal indications, for this encourages disregard for the stop indication at other locations. When turns are to be allowed in these cases, see that separate balls with left or right turn *green* arrows are shown beneath the red ball. Also at some locations left turn movements can be facilitated in the face of heavy opposing traffic by giving the left turn arrow a two- or three-second jump on the green indication for through traffic. This will not delay the overall traffic flow to any appreciable extent.

No mention has been made of the more complicated signal equipment and systems. The average engineer does not have the time to learn the details of their operation, and their need and use are largely limited to metropolitan areas. It is well to remember, however, that all of the larger signal manufacturers have a staff of well-trained technicians who are ready and willing to assist you.

If you have a signalized intersection that is unduly congested, don't be afraid to experiment with the timing, or even change the equipment if necessary. By observing the various traffic flows during the peak hours it is often surprisingly simple to make minor changes in the split, or cycle length, and greatly improve the overall conditions. Of course, you must expect a few dirty looks, and even rude remarks from the passing—or delayed—motorists when you are not lucky enough to hit on the proper arrangement immediately. Just remember that traffic is quite unpredictable, and few traffic "experts" ever set up a signal installation that functions perfectly during its initial operation.



● **CHANNELIZED intersection has heavy traffic on through road and major side road, with traffic from major side road fairly equally split in three directions.**

CHANNELIZING ISLANDS

No article on traffic control would be complete without some mention of channelizing islands. These islands are areas within a roadway, or intersection, so constructed as to establish physical channels through which vehicular traffic is guided. As with traffic signals, channelizing islands properly constructed after a thorough study of intersection conditions can be very helpful in facilitating traffic movements. However, poorly designed islands situated in the wrong locations are an unnecessary hazard.

Islands are of particular benefit at junctions having a surplus of paved area. They are placed so as to occupy the neutral or little used areas. In this way they prevent undesirable weaving and maneuvering of vehicles and reduce the possible conflict area between streams of vehicles. When well designed, they also establish better angles of crossing or converging traffic streams, provide a place of refuge for pedestrians and serve as convenient locations for other traffic control devices.

While specific warrants for the construction of islands cannot readily be set forth, one or more of the following conditions may indicate the need of channelization:

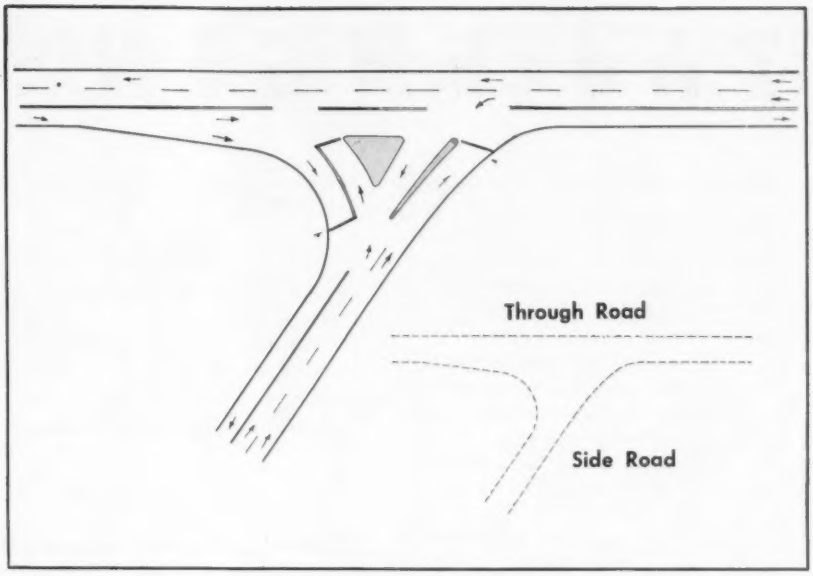
1. High accident rate.
2. Dense or high speed vehicular traffic.
3. Complex intersection.
4. Wide roadway.
5. Traffic control by standard signs and markings difficult.

Naturally, each location should be studied on its own merits. As a general rule, a few carefully designed islands placed to direct the predominant traffic volumes will prove far more satisfactory than a larger number of small islands placed to create too many channels. Numerous studies have been made which indicate the latter type designs invariably confuse the vehicle operators and result in new points of conflict.

At intersections having a wide "throat" we all know how tempting it is to pull out of a line of vehicles and cut the corner to make a left turn, regardless of the fact that this maneuver sets up unnecessary hazards and conflicts. One or two properly situated channelizing islands can entirely correct this difficulty without affecting the rather large turning radii necessary for truck traffic. In designing the islands, be sure that sufficient end protection is provided to prevent damage to the vehicle or the island. This may be accomplished by constructing the island of contrasting color to the pavement, or by painting, so that the course of travel is obvious. Pavement markings are invaluable in these cases.

Two examples of low-cost, or stop-gap, channelizations are shown by the "before" and "after" sketches herewith. In one example, there was a very heavy volume on the through road, with moderately heavy traffic

on the side road. Nearly all of the turning between the two highways was toward the stem of the "Y". High speed traffic on the main artery frequently peeled off into the side road, cutting the corner, and making it hazardous for vehicles entering the main road. In addition, left-turning traffic from the side road, stopped temporarily by traffic on the artery, blocked the path of the heavy left-turning movement from the main road, thereby greatly reducing the intersection capacity. The "after" treatment clearly indicates how the overall movements are benefited, and how the capacity has been increased. The other example shows what was done at a four-way county road intersection, where the movement from one leg was about equally split between left-turn, through, and right-turn movements. Channelizations of this type can usually be completed for a total expenditure of less than $5,000.



● **IN THIS example there is a heavy turning movement between the side road and east leg of the through road. Two islands and stop signs regulate traffic flow.**

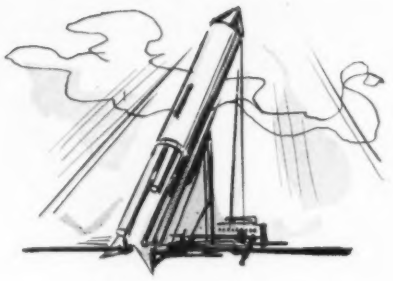
It is a good idea to lay out new channelizing islands by sandbags, pavement markings, stanchions or other temporary measures prior to the permanent construction in order to test their effectiveness under actual traffic conditions. Sand bags may be sprayed with traffic paint and dusted with beads to insure proper night-time visibility during the testing stage. It is also desirable to view the design from a high elevation, if possible. In this connection, it is interesting to note the oil patterns left by vehicles on concrete pavements in aerial photographs. One sees many an island that could have been designed a little differently to provide much better service. With a little patience in the planning, the engineer can provide a good, workable channelization, which will be one more step in unsnarling traffic—and at moderate cost.

The ENGINEER and

CIVIL DEFENSE is the responsibility of every citizen. Because of their technical skills, the engineer and public works director have an even greater responsibility in this vital activity than the average citizen.

Let me emphasize that each individual in the community, under the international situation which exists today, has at stake his life, the lives of his family, and the continued existence of his country with an acceptable standard of living. In addition, the engineer and public works director have the responsibility inherent in their professions —that of analyzing the many technical problems involved in civil defense, designing practical solutions, and assisting in a public education program. It is to these men that the average citizen must look for guidance in civil defense matters.

This responsibility exists in the same degree, for example, that it does in the promotion of safe buildings and adequate building codes. The public accepts the rules and regulations developed by the engineering profession in this area without question. They recognize the importance of the rules to their safety and general welfare. It is of utmost importance that the same people be made to understand that civil defense preparations fall into the same category.



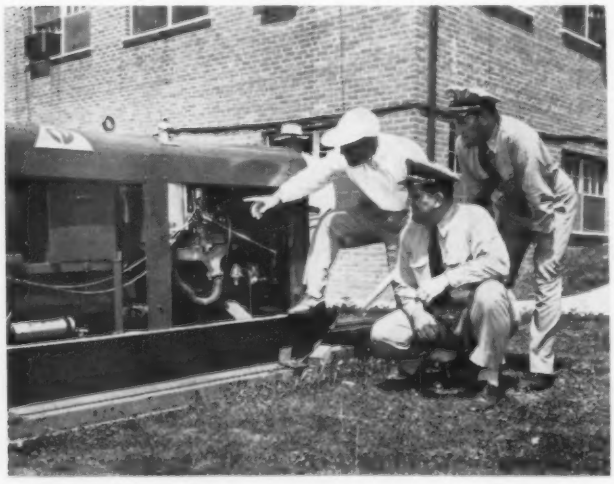
VAL PETERSON

Federal Civil Defense Administrator

Many persons today are convinced that the possibility of an enemy attack is extremely remote. They must be made to understand that the possibility of such an attack is very real and that, should it come, lack of preparation could be disastrous to every aspect of American life. Civil defense planning is important in every aspect of public works. Provision of safe water and sanitation facilities is vital in times of emergency. Military and civilian vehicles will fill our highways.

In metropolitan target areas, the problem which should be assigned the highest priority is that involving the technical aspects of evacuation. This includes development of an adequate warning system, traffic studies, route selection, route improvement, route markings, transportation media, and housing, sanitation and water supply for evacuees at suburban or rural reception centers surrounding the metropolitan area.

Next is the study of the area's shelter potential, and third is the formulation of plans whereby utility plants and industrial processes can be shut down quickly or put on automatic control so that personnel may be evacuated. It is important that those facilities not destroyed in an attack be put back into full-scale operation in the shortest possible time and proper technical planning can minimize the damage resulting from a temporary interruption of service.



● **PORTABLE** generators may be set up to provide emergency power for hospitals or other vital functions as needed.

● **SHORING** fire-weakened wall at right, an exercise at FCDA'S training school for defense workers at Olney, Md.

CIVIL DEFENSE

Emergency communications and radiological monitoring are other important areas requiring technical planning and guidance.

The Smaller Communities

The smaller communities are not likely to be direct bombing targets. Here the most important civil defense problem is support for bombed-out metropolitan areas and radiological monitoring of possible downwind fall-out from a bomb exploded over a metropolitan target.

Smaller communities must understand that their preparations to aid metropolitan areas is as essential to their own ultimate welfare as plans for their own civil defense. Economically and socially, our small communities and metropolitan areas are totally inter-dependent.

With the advent of thermonuclear weapons it is no longer possible to base civil defense planning on the use of available physical resources in critical target cities. Thus, where formerly the smaller and relatively safer communities could choose the degree of civil defense preparation they felt it necessary to have, it is now imperative that all communities, of whatever size or location, become a part of the planning which is so essential to the recovery of the nation from attack.

Civil defense thus becomes an area problem and planning must transcend political jurisdictions.

Evacuation

The evacuation of a community is dependent upon adequate warning of impending attack. Improved detection methods and equipment are continually lengthening the advance warning which can be expected in any given area, thus strengthening the effectiveness of planned evacuation.

There can, of course, never be a guarantee of adequate warning time for any specific city. It is always possible that one or more aircraft may slip through the warning net or that a nuclear weapon could be delivered to its target by a submarine-launched guided missile, or smuggled into the country. Further, there is the future potential problem of attack by supersonic intercontinental guided missiles armed with nuclear warheads, which could make it necessary to undertake a broad program of heavy shelter construction in our target areas at enormous cost.

For the immediate future, however, evacuation appears to offer the most effective means of saving the greatest number of lives.

In instances where sufficient advance warning is not received and the first warning indicates that attack is imminent, it would be necessary for the population of a metropolitan area to seek the best shelter available in an effort to save the maximum number of lives. This is a contingency with which we hope we will not be faced, but it serves to high-light the need for determination and identification of each area's shelter potential.

Planning the evacuation of a city, educating the public to accept this doctrine for their own welfare, and holding evacuation tests is a major undertaking, but an essential one for every target area.

If the public is properly trained in an evacuation plan—if participation in test evacuations is made mandatory for the public welfare—it is entirely possible that a real evacuation may be carried out without those involved actually knowing that attacking aircraft are on the way. Needless to say, in such a case the possibility of panic would be reduced almost to the vanishing point.

Surveys and Tests

Many of our cities have made considerable progress in planning for evacuation. A number have conducted evacuation exercises. Others have conducted studies of evacuation capabilities. The results of these exercise and studies indicate that,

● **FLEXIBLE pipe is laid by Civil Defense trainees at the Olney survival school. Flexible couplings make quick joints.**

● **A STORE might look like this after a bombing. In this exercise a rescue worker searches the debris for casualties.**

with sufficient warning, evacuation can be accomplished effectively.

In furtherance of FCDA's desire to encourage planning for evacuation, contracts have been executed with leading authorities to study the traffic engineering and traffic supervision potentials and limitations of Milwaukee, Wisconsin. This city was selected because it is reasonably typical of the major cities of the nation which front on a body of water, and because both the metropolitan area and the State were desirous of proceeding with such a study.

The contract requirements included: (1) a determination of the evacuation capabilities of the metropolitan area with existing facilities and varying weather and time of day conditions, (2) a determination of manpower, procedures, organization and location of traffic control and supervision needs of the metropolitan area, (3) recommendations on physical improvements which could increase the effectiveness of evacuation and an estimate of the cost of such a program, and (4) development of a prototype for traffic engineering evaluation which may be utilized by any city.

The surveys indicate that 80 percent or more of the 1,010,000 inhabitants of the Milwaukee metropolitan district can be removed from the evacuation area—roughly a circle 20 miles in diameter centered in the heart of downtown Milwaukee—in from three to seven hours, depending on weather conditions. If the old, the young, and the infirm—comprising approximately one third of the total population—were removed by strategic evacuation on the basis of developing international tensions prior to enemy attack, the 80 percent evacuation could be effected in from 1¾ to 4½ hours.

Further studies indicate that relatively minor construction improvements, costing less than $325,000, would result in a saving of half an hour or more in total evacuation time. More extensive improvements amounting to $6,625,000 would save an hour or more, and a system of freeways extending beyond the evacuation area would save more than two hours.

The traffic supervision phase of the study indicates that some 1,325 police officers and auxiliaries would be required to man 593 point control and highway traffic control posts.

Other tests have been carried out or are being planned to test the capacity of smaller communities and the so-called support areas to absorb and care for the homeless and temporarily dishoused persons after an attack. The establishment of reception areas; emergency mass feeding installations; temporary lodging from weather extremes; centers for registration, information and for the reuniting of families; and specialized assistance to people in need are other phases of civil defense which must be studied. Notable work in support planning has been done in New York State and California.

National organizations, associations, and industrial and military groups have lent support to planning which has been initiated in this respect. The rural areas in some States, spearheaded by farm organizations and women's groups, have begun to develop studies of their capabilities in handling the problem of evacuees in the event of a disaster. Weld County, Colorado, is such an example. New Market, Maryland, is another. The experience of these communities will be of great value to other areas where steps are under way in developing civil defense support planning.

The Task Ahead

Evacuation is becoming practicable because most American cities are no longer limited to the 15 minutes of attack warning on which some past planning has been based. Depending on their location, many target areas are now reasonably sure of at least an hour's warning time. As the Air Force system of radar and other detection devices moves up toward completion, more cities will gain more time. It is expected that within 24 to 30 months most target areas will have as much as four to six hours' warning.

Meanwhile, we must strive unceasingly to develop evacuation plans which will work. We must conduct frequent test exercises until each citizen knows exactly what he must do to save himself. I simply refuse to believe that there is not enough brainpower in our cities to develop workable plans for saving millions of American lives.

It should be pointed out that during "Operation Alert", the nationwide civil defense test exercises of June 14-15, 1954, the city of Mobile, Alabama, successfully conducted the first large-scale evacuation of a downtown area. First on foot, then on wheel, civil defense moved more than 30,000 persons from an area five miles long and three-quarters of a mile deep, constituting the downtown core of Mobile. Within twenty minutes they were two miles out of the area and rolling uninterruptedly. Preliminary estimates by traffic experts allowed at least an hour for this.

When the bombs fall, survival will depend on what we are able to do then. If we don't know what to do, it will be too late to learn. Engineers and public works directors cannot afford to lose sight of this. They cannot afford to neglect the opportunity provided by the fact that they are in key and strategic positions to make and influence civil defense policy.

Following are some recent FCDA publications likely to be of value in this respect and available through your local or State Civil Defense Office:

Technical Engineering Publications Released in 1954

TB-5-1. Interim Design Standards for Protective Construction in Industrial Structures.

Annex 9-G. to Contributions Manual M25-1. Standards for Control Center Construction.

TB-13-6. Utililation of FCDA Stockpiled Portable Water Purifiers and Storage Tanks.

TB-13-7. Utilization of FCDA Stockpiled Vinyl Film.

TB-13-8. Utilization of FCDA Stockpiled Mobile Chlorinators.

TB-13-9. Restoration of GAS Facilities in Civil Defense Emergencies.

TB-13-10. Sewage Works Facilities in Civil Defense Emergencies.

TM-13-3. Clearance and Restoration of Streets and Highways in Civil Defense Emergencies.

M6-1. Supplements and Revisions to "Standard Item Specification".

Supplement to TB-13-5. Utilization of FCDA Stockpiled Lightweight Steel Pipe and Centrifugal Pumps.

DETROIT'S CIVIL DEFENSE CONTROL CENTER

WALTER A. JENKINS,

Operations Coordinator,

Detroit Office of Civil Defense

AS DETROIT embarked upon a full scale civil defense program under the leadership of Brigadier General Clyde E. Dougherty, Detroit and Wayne County Director of Civil Defense, use of existing facilities enabled the civil defense plan to become operational immediately. Many phases of this hastily developed plan were admittedly far from ideal. As refinements of the organization began to emerge, it was obvious that an adequate and smooth operating control center was the key to overall operating efficiency. No longer could civil defense in Detroit depend upon the limited control center facilities provided during the first rush of activity. The interim control center, located in a vulnerable section of the city, had served its purpose in providing the best facilities available during the critical organizational period.

One of the limiting factors in planning for an adequate control center was cost. Considerable savings could be effected if a suitable control center location could be found in an existing building. The requirement that the control center be located well outside of the critical target area appreciably cut the number of potential locations. A survey was made of existing city owned buildings having space available which might be considered for the establishment of a control center. The result of the survey was conclusive—no suitable space could be found.

Embarking upon a project with little previous experience to draw upon—no city had, as yet, constructed a building of this magnitude designed primarily as a control center—the Detroit Office of Civil Defense outlined its control center needs and had a building designed to fill these requirements.

An area of 12,000 square feet was developed "on paper" to provide the necessary space so that all civil defense services could properly operate in an emergency from a headquarters within the control center.

The firm of Smith, Hinchman, and Grylls, Architects and Engineers, offered to develop the design of the proposed building from the preliminary sketches as a public service without charge.

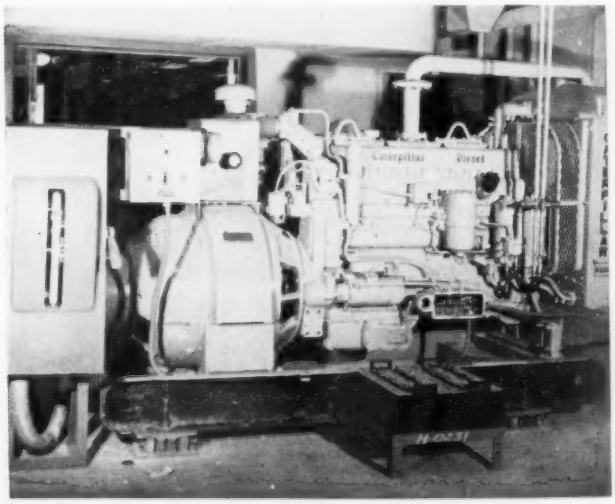
The basic facts which were to be considered by the architect in designing a suitable building were as follows:

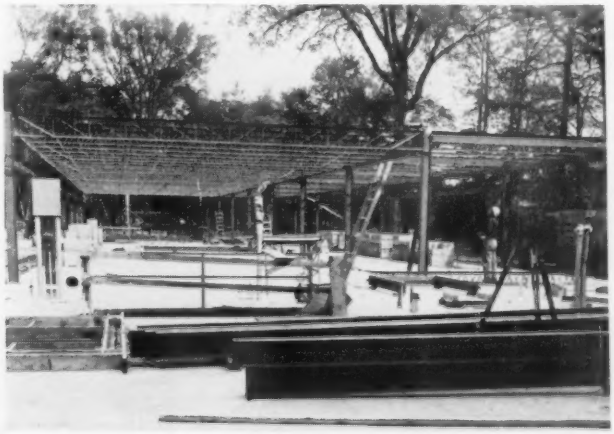
1. Total construction cost not to exceed $250,000.
2. Building to consist of a basement and one story, each having an area of approximately 12,000 sq. ft.
3. Basement Section (control center) to withstand the effects of a nominal A-bomb blast when ground zero is a minimum of one-half mile from the building.
4. First floor section of building to be of ordinary construction and considered expendable in case of attack.
5. Design of the building to be compatible with the long range plans of the Department of Parks and Recreation so that the building would be desirable for their use should its occupancy by Civil Defense terminate.

Working closely with personnel from the Detroit Office of Civil Defense, the architect proposed a building approximately 50 ft. x 250 ft., with basement walls and ceiling slab of reinforced concrete, and the first floor of steel and masonry, with a flat, steel deck roof.

The superstructure of the building approved for construction consists of a light structural steel frame and

(*Continued on page* 172)





● **STRUCTURAL** steel frame for first floor, above, and 80 KW Diesel engine generator which furnishes emergency power.

CONCRETE and SOIL-CEMENT *Makes Economical Reservoir Lining*

WALTER MULLINS,

Mayor, Alamogordo, N. M.

ALAMOGORDO is a hospitable community of comfortable size, with enough activity to insure a bright future. Located at 4,350 feet in the semi-desert Tularosa Basin, the city is at the immediate foot of the Sacramento Mountains. Alamogordo must depend upon this mountainous watershed for most of its supply because rainfall in the Basin is about 11 inches annually compared with 25 inches a year in Cloudcroft, a resort town at 9,000 feet elevation and only 18 miles distant.

In 1940, the population of Alamogordo was 3,950; in 1950, 6,783; and by midyear 1954, 11,000. In this arid region, the municipal water problem, in addition to the population surge, is aggravated by the necessity for supplying Holloman Air Development Center, core of the nation's rocket research.

With both the city and Holloman growing rapidly, the city officials have procured the mountain water rights along two canyons in the Sacramentos. Also, a system of storage has been devised in order to make maximum use of the new rights. During 1953, the total water storage capacity for the municipal supply was 7,000,000 gallons. This reserve supply, to supplement 3 deep wells, was barely adequate during the 1954 high demand season. To meet the future demands, more wells are being drilled and the storage capacity has been increased more than ten fold.

During the latter part of 1953, a Federal grant of $525,000 was obtained to construct small diversion dams along the Fresnal Canyon, a pipeline to collect this water, and two 40,000,000 gallon open storage reservoirs to hold the water for the peak demand periods during July and August. The construction of

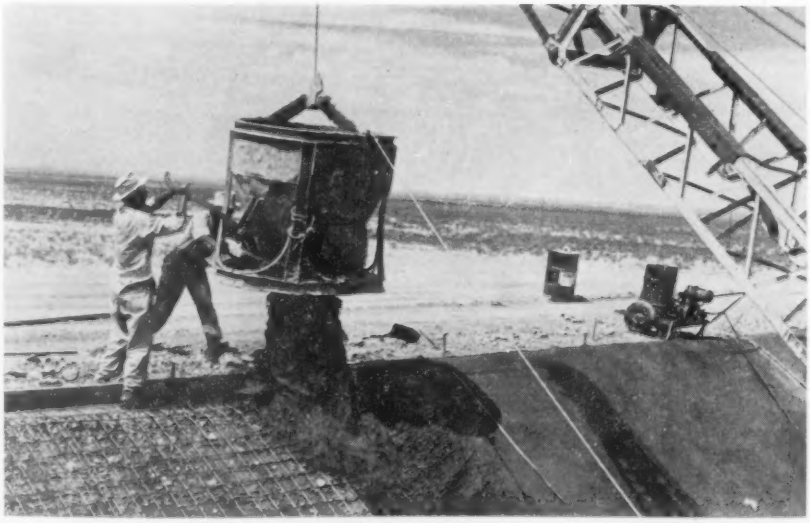
TABLE 1 — QUANTITIES AND COSTS

	Cost Per Sq. Yd.
Lining	
Concrete — 1,725 cu. yd. at $27.00	$2.25
Reinforcement — 199,000 lbs. at 0.14	1.35
Reinforced concrete side slopes	$3.60
Bottom	
Cement (s-c) — 4,914 bbls. at $5.00	$0.675
Process (s-c) — 36,449 sq. yd. at 0.10	0.10
Water (s-c) — 562 M gal. at 2.00	0.032
Cure (s-c) — 36,449 sq. yd. at 0.04	0.04
Soil-cement bottom	$0.847

Total Cost for Two Reservoirs

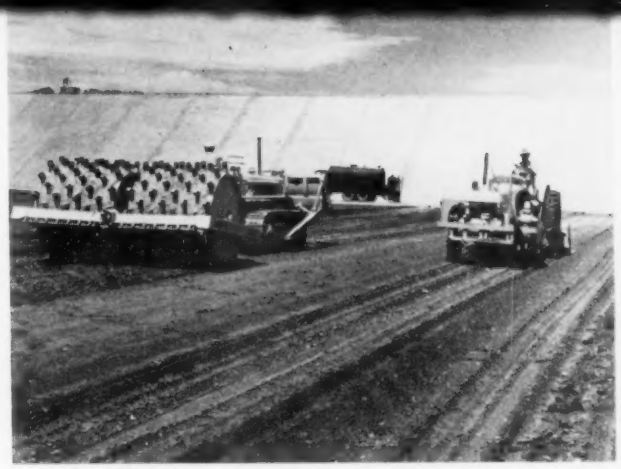
Excavation — 220,696 cu. yd. at 0.24	$52,967.
Embankment, rolling, water, etc.	13,289.
Concrete (structures) — 265 cu. yd. at 27.00	7,155.
Reinforcement (structures) — 37,183 lbs. at 0.14	5,205.
Reinforced concrete lining — 20,650 sq. yd. at 3.60	74,340.
Soil-cement bottom lining — 36,449 sq. yd. at 0.847	30,872.
Approximate Total Cost 2 Reservoirs	$183,828.

Capacity — 80,000,000 gal.
Cost per 1,000 gal. of storage — $2.30*
*Does not include pipe details



● **MOBILE CRANE** operating from the bottom grade of the reservoir placed concrete for side slopes. Approximately 100 lineal feet were placed per working day.

● **MIXER** incorporates Portland cement and water with existing bottom grade soil. Water truck is in background.



● **SHEEPSFOOT** roller gives initial compaction of soil-cement mixture as the mixer passes in opposite direction.

the two large reservoirs, included the use for the first time on such a large project of the soil-cement —reinforced concrete combination.

Preliminary plans were drawn by the city's consulting engineer in 1953. First intentions were to line the large cavities with concrete, but due to a shortage of funds, an alternate method had to be devised. The city wanted to line the sideslopes with concrete to take advantage of its minimum maintenance features on the most critical part of the reservoir, but had to have a low-cost lining for the bottom portion. In addition to preventing seepage losses, the bottom lining had to be stable and strong enough to support light construction equipment to be used during cleaning operations, including the removal of slit deposits. After thorough investigations, there appeared to be only one type of construction to meet the requirements, that being soil-cement. Since the cost of constructing soil-cement in such a confined area, was not known, the city also called for two other types of lining on an alternate basis. Final plans were completed and bids called on December 15, 1953. The soil-cement—concrete alternate was low in first cost, and was the only proposal that met all of the requirements, so an award was made on the basis of that lining method.

Eighty million gallons sounds like a lot of water, but to see the large reservoirs is much more impressive. Each tank is 405 feet square on the bottom (almost 4 acres in area) and 28 ft. deep; sideslopes are 1½:1 and each tank has a concrete roadway to the bottom for easy access during cleaning operation.

Reinforced Concrete Sides

The 1½:1 side slopes are lined with a heavily reinforced concrete slab three inches thick. Reinforcement consists of 6x6 0/0 welded wire fabric with joints lapped nine inches. The steel is designed as continuous reinforcement and concrete was placed continuously in vertical strips. No expansion joints were placed except at structures and at the intersection of the lining with the roadway slab. Approximately 100 lin. ft. of lining was placed each normal working day with a construction joint at the end of each day's work.

The concrete mix design called for a minimum of 6.3 sacks of cement per cubic yard and a maximum aggregate size of ¾ inch. Mixing was done by use of a 5-sack Rex concrete mixer and the concrete was placed on the slope with the aid of a truck mounted crane with a 60-ft. boom and ¾-yard bucket. Two men leveled off the concrete and four men finished the wood-float surface. A membrane curing compound was sprayed on the surface immediately behind the finishers.

Soil-Cement Bottom

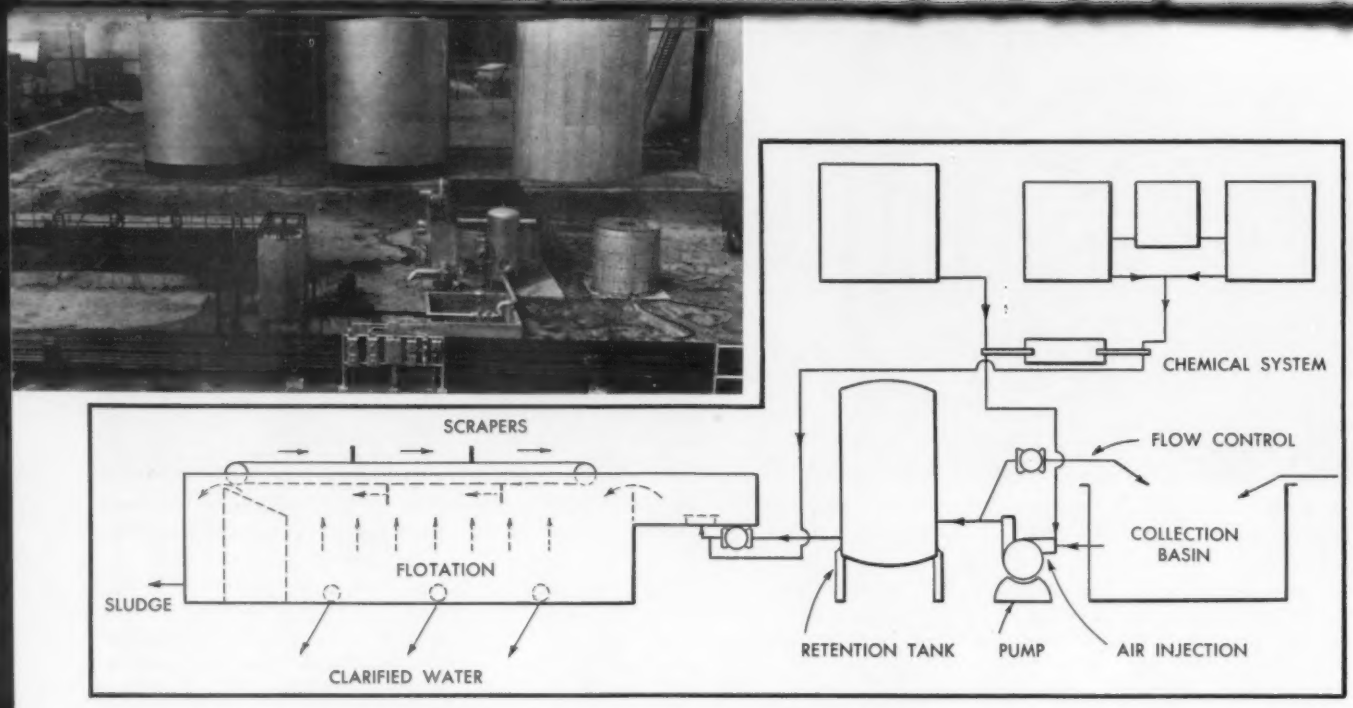
The final bottom grade, from one foot fill to thirty foot cut was mostly a rocky material which had to be replaced with a finer material. This borrow soil was a sandy-silt-loam, and laboratory tests indicated a cement content of 12 percent by volume was required; so the reservoir bottom is lined with a compacted mixture of 88 percent soil and 12 percent cement.

Normal road construction equipment was used for the soil-cement operation with an average of 3,500 sq. yd. of lining placed each 8-hour working day. Equipment used included a self-propelled Seaman Pulvi-mixer, motor grader, rubber tire and steel wheel rollers, weeder attached to a Ford tractor and water-tank truck. After final rolling with the steel wheel roller, 0.2 gal. per sq. yd. of RC-2 asphalt was applied for a curing membrane.

The project was designed by W. F. Turney & Associates, Santa Fe, N.M. P. R. Burns, Las Cruces, N.M. was the contractor with Dennis Walker, Construction Supt.

● **CONCRETE** was placed on side slopes from the top down.

● **PNEUMATIC** tire roller compacting soil-cement bottom.



● **FLOW DIAGRAM of "Colloidair" separator in an industrial waste application. Inset shows Leonard Refineries installation.**

IMPROVED WASTE WATER CLARIFICATION *by* DISSOLVED-AIR FLOTATION UNIT

C. E. FISKE and PAUL MERNITZ, Leonard Refineries, Inc., Alma, Michigan

AFTER A THOROUGH investigation, the management of Leonard Refineries, Inc., in Alma, Michigan, decided to add to its facilities for waste water clarification. Average effluent flow of 180/200 gpm, with peaks near 400 gpm, made it impossible any longer to hold the oil content of the water below 80 ppm at the trap outlet. Further clarification with hay dams and manual skimming was of doubtful and erratic efficiency and quite costly.

Of the various commercial separators that were offered, the dissolved-air flotation process for further reducing the oil and grease content looked most attractive for three reasons. First, the installation could be a compact package unit, offering good clarification with only about 18 minutes retention time at full flow. Second, although alum or other chemical feed was to be used for the best oil reduction, it was claimed that the dissolved-air flotation principle could still yield a substantially better effluent water even should the chemical feed system fail. Third, there was an excellent chance that the separated oily skimmings could be kept to volumes which would not require any dewatering system for sludge disposal. Since the proposed air-flotation unit was competitive wth sedimentation clarifiers at the same throughput rate, this last consideration meant that the capital investment might be held to a minimum.

Accordingly, a 500 gpm Bulkley-Dunton "Colloidair" dissolved-air flotation separator was brought on-stream at Leonard on July 11, 1954. It has been operating continuously since that time, handling varying compositions of waste water at 150 to 500 gpm flow, and yielding relatively clear sparkling water of below 10 ppm oil and grease at an alum feed rate of 65 ppm.

Operation of the Colloidair Separator

The Colloidair unit is installed downstream of the existing API trap which it supplements rather than replaces. It picks up the water and pumps it into a 2 to 3-minute retention tank in which it is saturated with dissolved air at 25-35 psig. Chemical feed, if used, is continuously proportioned to the waste flow and solution-injected on the pressure side.

Passing from the retention tank through a pressure release valve, the water enters the inlet end of the flotation tank where colloidal air bubbles come out of the solution. These adhere to the oily particles to sweep them to the surface. Chemical floc-formers aid in this operation by forming a structure which effectively holds the air in an oil bearing froth.

Moving from the inlet end, the water flows over a submerged weir through a relatively non-turbulent flotation chamber of 190 sq. ft. area (in the 500 gpm size) and 6,750 gallons capacity, from which nine flight-scrapers on an endless chain skim the oily froth over another sludge-recovery apron weir. Clarified water is continuously withdrawn from a series of four transverse collecting pipes near the bottom. The withdrawal tubes make a right-angle turn upward through the clarified-

water collecting basin, and are adjustable in vertical rise to permit level control of the flotation chamber. Discharge from the clarified water collecting basin is over a flow-measuring weir, from which the water goes to outfall, recycle or further treatment.

The main pump in this system is rated at 500 gpm at 90-ft. head, and must take flooded suction at all times. In order to provide for variable flow of waste into the system, the suction pit is automatically maintained at constant level above the pump inlet by recycling some of the water. The recycle rate is controlled by a pneumatic valve actuated from the liquid level float in the suction pit. For gross overload exceeding 500 gpm, such as might eventuate from very high ground water runoff, a short-circuiting overflow is provided in the suction pit itself well above its normally maintained level.

Adjustment to Maximum Efficiency

After completion of a shakedown run in the presence of the vendor's engineer, the better part of a month was spent by Leonard personnel in determining water characteristics at varying rates of chemical feed, air pressure, scraper-flight speed and retention tank levels.

The criteria were: Acceptable oil and grease removal (less than 10 ppm), minimum practicable sludge volume and most economical chemical feed rates. After each variation, a day or two was allowed to attain steady-state conditions.

The best balance of these conditions bearing directly on residual floatable oil and grease were found to be as follows:

1. Alum feed, from a one-pound-per-gallon solution, about 60 ppm. In general, the pH averaged about 8.3 with swings to 6.5 and 9.7. Alum in excess of 60 ppm offered no advantage, adding to the cost and to the volume of the recovered sludge. Above pH 9, alum floc tended to peptize, i.e., the floc particles fell out and appeared in a non-coagulated form in the clarified effluent. The result was "black water." The violent pH swings were quickly traced to caustic neutralizer plant dumps and to boiler house softener wastes, both non-oily streams which have been since piped directly to waste. While 60 ppm of alum may not be the absolute minimum, it is felt that the chemical cost of $3.34 per day for treating 260,000 gallons of water is not excessive, and will provide a good margin of safety, since emulsified oil is occasionally a factor.

2. Scraper-flight speed. Best results have been obtained with the minimum lineal speed of 16 inches per minute. At the average flow of 181 gpm, average retention time is 37.5 minutes. Since the skimming basin (flotation chamber) is 20 feet long, the minimum flight speed is 15 minutes per traverse. It is felt that such a relation offers least chance of turbulence at the skimmed layer. The danger of increased fallout of floc into the effluent at the downstream end has not materialized.

3. Design air pressure of 25-35 psig has been maintained. During times of lower-than-average throughput, a relatively large proportion of water recycles to the suction pit to maintain flooded suction. Under these conditions, a pressure drop of up to 20-30 percent is experienced in the retention tank, which means that less air is dissolved in the raw water. However, since less water with its load of oil is being processed at such times, the net effect is to maintain adequate flotation.

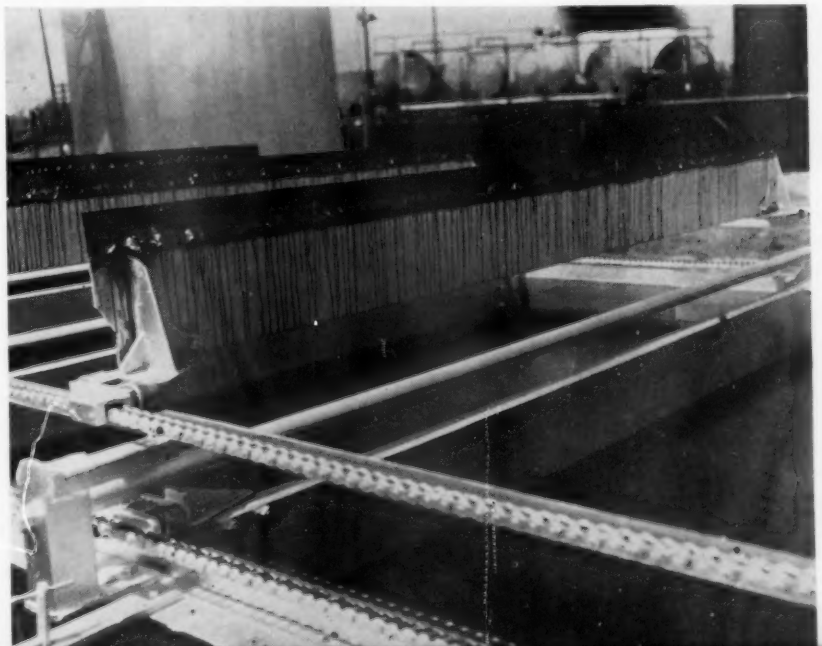
The best retention tank level was found to be one at which the oily sludge was concentrated to approximately 2% of oil. This adjustment is a rather coarse one, made by adjusting the length of the clarified-water riser pipes. Attempts to concentrate the sludge further by lowering the flotation tank level led to increased fallout of oil-bearing flocculent since it was being skimmed inefficiently.

Very little trouble has been encountered in a mechanical sense, all of a minor nature. The neoprene scraper blades have lost much of their strength by continued contact with oily water, and have swollen and corrugated badly in the three months' time. An experimental Saran formulation has been obtained and was recently installed on one of the flights. Its performance, while satisfactory for two months, cannot yet be judged in comparison to the neoprene. Minor alignment difficulties have occasionally caused the flight scrapers to untrack over idler cogs.

Floatable Oil Removal

The analytical method used in reporting oil and grease contents was developed by Pomeroy[4] for floatable oil and grease. This method mimimizes sampling difficulties, avoids the errors caused by significant solubility of inorganic salts in the direct ether extraction method, and is well adapted for routine testing. It is necessary, however, to acidify the grab samples before allowing flotation. The Noll[5] method was discarded when it was found that addition of $FeCl_3$ solution, preparatory to producing $Fe(OH)_3$ floc in situ, oxidized sulfide ion to sulfur, which showed up in the ether extract of the floc-fixed oil.

Over a 2-week period of test, the water characteristics summarized in Table I were found, with extremes as indicated. Each instance of residual grease and oil over 10 ppm was found to be associated directly



● **CLOSE-UP of flight scrapers which continuously traverse the tank to remove floating grease and oil.**

TABLE I — Refinery Waste Water Characteristics — 2 Week Test Run

Property	"Colloidair" Influent Water			"Colloidair" Effluent Water		
	Min.	Avg.	Max.	Min.	Avg.	Max.
Rate of flow, gpm	110	181	412	110	181	412
Floatable oil and grease, ppm	28	86	573	2.2	4.0	36
Water Temperature, °F[1]	—	—	—	103	115	125
Sulfide (as ppm S)	40	281	1710	18	208	406
pH	5.7[2]	8.4	9.7[2]	5.7[2]	8.3	9.7[2]
Specific Conductance, Mhos	1050	2115	10,000[2]	1200	2200	8000[2]

[1]Period in Mid-July
[2]Related to caustic neutralizer or softener system dump.

with improper pH conditions, usually a caustic neutralizer plant dump. With the diversion of this non-oily stream it is felt that oil-removal and clarification yields completely acceptable water, well within the limit of oil contamination set up by State authorities.

Effect on Other Water Properties

Hopes were entertained that the intimate contact of the waste water with oxygen, such as this system employs, would substantially clean up the water with respect to phenol, sulfide and BOD. Aside from the obvious improvement in BOD made by removal of organic oily materials, that hope has not been realized. If biological oxidation of such contaminants was indicated before oil and grease removal, it will be no less necessary after, in the experience of Leonard. However, the prior reduction of oil and grease concentration is a definite forward step in the successful operation of trickle filtration, which many refineries will need for phenol removal.

No analytical data on removal of non-oily solids has been reported. However, the clarified water samples taken have invariably been clear and sparkling, with no visual evidence of heavy sediments going to outfall.

Sludge Disposal—At the present throughput rate, Leonard is recovering some 30-40 gpd of oil and grease, whose bulk is augmented in the recovered sludge tank by flocculent and temporarily entrained air. Total waste in this tank amounts to some 80-100 gpd, which is, of course, a more dilute concentration than the 2 percent of oil cited above. The difference was believed to be due to temporary surges of high levels, for which the unit does not compensate. This volume has been pumped off to ponding areas for disposal where it has offered no problem. It has been made automatic, using a float controlled 3 HP rotary pump.

● GENERAL VIEW showing the Bulkley-Dunton "Colloidair" separator installation.

Investment and operating costs—The 500 gpm unit installed at Leonard was purchased for about $23,100 including the sludge transfer pump, fir chemical tank and chemical feed system. Additional piping, concrete pads and drywell and other materials brought the total material cost to about $26,550. Installation labor was about $2,425, to a total of nearly $29,000.

Power costs are about $5 per day for the four pumps required. Chemical feed (alum) costs about $3.34 per 24 hour day, or $0.0125 per 1000 gallons. Maintenance, alum solution makeup and miscellaneous attention amounts to about 1½ hours or $3 per 8 hour day.

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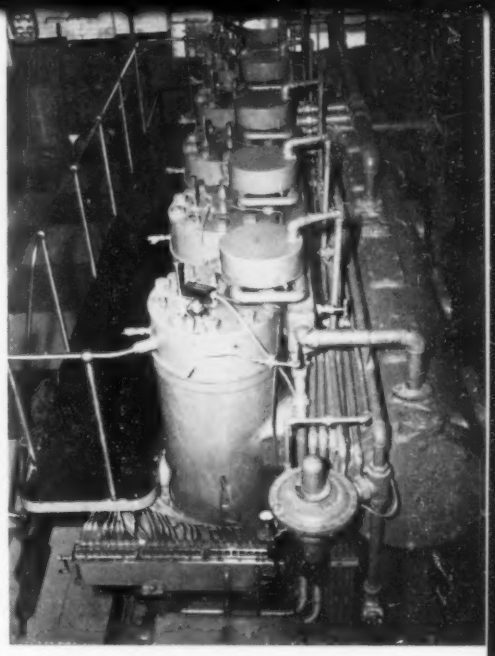
It Costs Money to Be Short of Water

Problems experienced in handling water were recounted by John Akin, Sup't. of Water Works, Pittsfield, Ill., at a meeting held under the auspices of the State Department of Health of Illinois. The Pittsfield reservoir was depleted in December, 1953, having had periods of difficulty since 1936 when restrictions on water use were first necessary. In four months time, the city spent $41,000 in hauling water. In all, some 12,000,000 gallons of water were trucked to the city. The water rates were raised during this period to $6 per 1,000 gallons, with the average water bill running about $20 per month.

Effingham also had a similar situation, although the reservoir was not completely depleted. Albert Rechtiene, Sanitarian, of the Effingham County Health Department, described the pumping of water through an abandoned 8-inch oil line from the Embarrass River to the Effingham reservoir. Some $16,000 was spend on this project.

Converting a DIESEL for DUAL-FUEL Operation

L. E. CLARK, Superintendent, Broken Bow Municipal Utilities



● DIESEL engine with conversion equipment for use of natural gas fuel.

THE original natural gas conversion unit for Model 32 Fairbanks-Morse engines was developed in the Broken Bow (Nebraska) municipal power plant. This equipment has been well tested in service since July, 1953.

Hundreds of these Model 32 engines have established enviable records in diesel power plants throughout the world. Simple and rugged, these engines have lost some of their reputation as producers of cheap power only because no suitable equipment has been available to convert them to use cheap natural gas for fuel. The F-M Model 32 is a 2-cycle engine and has no cam shaft or valve mechanism. In contrast to nearly all other diesel engines there is no mechanism readily available to operate gas admission valves.

We have devised a system which has, as its original feature, gas admission valves operated by timed low pressure air which is obtained from engine crankcases. The simplicity and reliability of the Model 32 is preserved. Air is available from the engine crankcases at about ¾ pound pressure. This air is properly timed and is used to operate the gas admission valves located in each cylinder head. These gas admission valves replace the original air start valves and serve the dual purpose of admitting gas and acting as air start check valves. A large piston and cylinder form the upper part of the assembly. Each time that air pressure is admitted to the cylinder the piston is forced down and the gas admission valve is opened. This is timed to occur just after the exhaust ports close and before there is any appreciable rise in compression pressures.

An air distributor is located adjacent to the front end of the governor case and is driven by gears installed within that case. In consists mainly of a ported housing containing a rotor with a single port. Each housing port is piped to its respective gas admission valve actuating cylinder. The rotor receives air from the actuating air manifold, communicates with the various ports in the housing in proper time and causes the air to flow, operating the gas admission valves so connected. The rotor serves the further purpose of uncovering these ports and relieving the pressure against the actuating pistons permitting the gas admission valves to close in proper time.

The air needed for this operation is obtained by the use of weak spring check valves installed at each crankcase. These valve assemblies replace the inspection plates located over the main bearing air stop rings. Air from each valve housing is piped into the actuating air manifold. Check valves are installed in the original air start lines to prevent the return of gas into the air start system. Check valves are also installed to prevent starting air from entering the gas manifold.

Gas Pressure Control

Natural gas, as it is received, passes through a Fisher pressure regulator and is reduced to a constant pressure of about 18 lbs. Gas next passes through a butterfly valve which is controlled by the governor. From this point on, gas enters the manifold and pressure varies according to the load carried on the engine. A balance of load between cylinders is accomplished by the use of gas cocks in connections to the individual cylinders. Adjustments are stable and few changes are required after the original break-in.

Injection nozzles are used which have been specially developed for dual fuel operation, have connections for use with separate pilot oil injection pumps and have check valves in the main injection lines.

Original injection pumps serve for injecting pilot oil. Inherently, the timing of these injection pumps is not uniform enough for the very best performance in pilot oil service making necessary pilot oil quantities of 15 to 25 percent. The most practical dual fueling of the Model 32 will incorporate separate pilot oil injection pumps and will reduce pilot oil to lower valves.

A mechanical trip device is connected to the original over-speed governor. This closes a valve in the gas line in case of Woodward governor failure or overspeeding of the engine for any reason.

The governor adapter assembly which is used on this Model 32 conversion enables the governor to control both gas and fuel oil and is actually far superior to many of the changeover devices in use on other engines today. This is a variable ratio device and is built on well known mechanical principles. The best feature is that the governor retains full control of both fuels throughout the changeover operation. The full swing of the governor is used for both diesel and dual fuel operation. The system is adaptable to automatic changeover if that be desired. Pilot oil is easily adjustable with or without separate pilot oil injection pumps.

When model 32 Conversions are commercially available, plants having these engines should be able to realize, with simple equipment, the economies and low costs generally associated with dual fuel equipment.

STREET *Maintenance* in LOS ANGELES

GUY BROWNING ARTHUR

THE Bureau of Street Maintenance in Los Angeles is one of ten bureaus in the Department of Public Works. The General Superintendent is L. Miller; his Assistant is B. R. Paris. For operating purposes the Bureau has three major divisions: Street Maintenance, Lot Cleaning, and Street Use inspection. It has 1580 full time employees.

Within the city area of 453 square miles—larger than any other city area in this country—there are 6,182 miles of highways, streets and alleys carrying a staggering concentration of traffic. The policy of any organization charged with maintaining such a labyrinth of public ways must be arresting. The policy of this bureau is "preventive maintenance": getting there ahead of trouble.

For example, resurfacing is not done under pressure of complaints about broken pavements, with a back-log of unfinished work. It is done in an ordered program of reconstruction in which the emphasis is on the age and condition of the "prior" pavement. When an evaluation determines that the time has come for resurfacing, the pavement is re-built as thoroughly as may be warranted by the base and the traffic to be carried. The new surface is geared to this study by choosing a mixture of a certain quality and thickness that will give a desired life expectancy. The crews of the resurfacing trains are well versed in the behavior of different surfaces on different types of foundations, and they contribute much practical advice on what to lay and how, to be sure of the results desired.

When a pavement has lasted 25 years, for example, the prior growth of traffic on the street may be known or estimated. Projecting the wear on the new surface into the future, in terms of density of population and traffic, and prescribing a mixture and thickness that will make good on the estimate, is not an easy undertaking; but this is what they try to do. They project their plans and budget estimates well into the future, expecting to stay between the limits of complete and partial success. In an evaluation of their method it must be conceded that the objective is worth all it costs in time and experiment. A by-product of the study worth mentioning is the broad interest in the job of resurfacing which is generated throughout the Bureau, enlisting the participation of every man in the crews.

● **"STREET CLEANING" in Venice, a Los Angeles subdivision, includes a weekly patrol by workers on a barge. One of the intricate truss bridges is in background.**

Street Maintenance Division

Most of the work which is comparable with that in other cities is done by this division. It has 1488 civil service employees in various classifications, the bulk of the personnel in the Bureau. It has an equipment fleet of 1166 units, of which 730 are motorized and the others trailer units. Its work covers the city, but while some of its 9 sections work over all streets, there are three areas—North, South, and San Fernando Valley—which operate separately.

Street Cleaning Section cleans all improved streets, including pedestrian and vehicular tunnels, except the San Fernando Valley. Its work is based on motorized sweepers, supplemented by hand sweeping in business districts. Motor flushers are used behind the sweepers in the downtown business districts during the night. The cleaning cycle ranges from daily coverage in retail districts to eight times a year in some single-dwelling residential areas.

More than 360 employees are assigned to this section, with 32 motor sweepers, 60 dump trucks, 12 motor flushers, and 24 miscellaneous units. During the last fiscal year 434,653 curb miles were cleaned at a total cost of $1,764,906, which is reduced to a weighted cost of $4.28 per mile.

Street Resurfacing work is divided into two parts: a continuing study of problems and the actual resurfacing. The study side of the work has already been discussed, and some of the active phases are on paving defects, tests for roughness, and the cost of maintaining pavements by different methods. How to perform the work where there is heavy traffic is a special problem. High crowns built up by successive applications of maintenance blankets is another. What to do with streets where car tracks have been abandoned is still another, and there were 8 miles of this in the past fiscal year.

The 132 employees operate 9 motor graders, 14 road rollers, 12 mechanical loaders, 21 dump trucks, 4 asphalt paving units, 4 asphalt surface heaters, and 55 miscellaneous units.

In the total resurfacing operation there is a manhole crew and the resurfacing crew. The graded-off street may have to stand for some time before the manhole crew can come along to raise the manholes and do the necessary leveling. Usually the resurfacing crew follows close behind the leveling work. A reconstruction train is used for resurfacing streets. This consists of a burner, a grader, and loader. The burner unit was designed within the bureau and cost $22,000. It heats a wide swath at even temperature, fully controlled to synchronize with the nature of the old surface and the speed of travel. The most effective speed of travel, if the old surface permits, is about 8 ft. per minute.

A motor grader has been found best for following behind the burner. It cuts 1 inch below the gutter level, and pushes the material off to one side, where it is picked up by the loader and lifted into trucks. The distance held by the grader behind the burner is another factor that is watched constantly by the crew. They find that immediately behind the heater the surface is too soft to handle well. The material continues to heat below the surface for some minutes, and it is better to allow this heat to penetrate. Keeping the grader from 20 to 25 ft. behind the heating seems to get best results. Then the material comes up easily and is not gummy.

The timing of different parts of the whole job is influenced by interests outside the Bureau. Merchants may not be willing to have any work done that stops traffic, especially during particular seasons like Christmas. Care is taken to do all closed-street work at times when it will not stir up criticism.

Two of these trains are kept busy all the time, going from one section to another, keeping their parts of the whole job in close coordination. When necessary the curb and gutter crews are pulled into the team to work with manhole crews, rebuilding concrete structures along with the leveling.

During the last year 90 miles of street were surfaced or resurfaced. All types of pavement were removed and renewed with armor coat, or blankets, and there was a substantial amount of complete rebuilding, along with curbs and gutters. Nearly a mile of new construction cost $41,346.

● **ASPHALT mixing plant is one of three operated by the city. Efficient truck dispatching keeps pace with plant production and minimizes storage requirements.**

The *Asphalt Plant and Transportation Section* operates three city-owned asphalt plants with 36 employees and 50 trucks and drivers. The plants produced 450,000 tons of mixtures at about $2.64 per ton. One of these plants is being rebuilt, and two will then carry the load, keeping the third as a standby.

In the *Trench Replacing Section* 190 employees have 35 trucks, 5 compressors, 21 concrete mixers, 4 motor graders, 4 road rollers, 6 skip loaders, 27 trailers, and demolition tools. This section has been in the "red," showing a loss of $25,000 in replacing 68,573 excavations at a cost of $1,453,178, for which the city had a return of only $1,428,296. The rates for replacing have recently been increased, so the next statement will look better.

The *Structural Maintenance Section* has a wide spread of work as

(*Continued on page* 167)

● **RESURFACING crew places a new bituminous surface over old street car tracks during an improvement program.**

NEW MAST ARMS for NEW YORK CITY TRAFFIC SIGNALS

LAWRENCE LAWTON
Director of Traffic Planning,
Department of Traffic,
New York, N. Y.

THE FIRST installation of new type signal mast arms, designed to give increased visibility to drivers, was recently installed at the intersection of 7th Avenue and 42nd Street. Located in the heart of the Times Square area, the installation dramatically proved the advantages of mast arm suspension of signals. Instead of the signals being pedestal mounted on the sidewalk, the curved arm brings the signal directly over the roadway.

Maximum visibility of traffic signals is obtained by the use of the new mast arm. Because of the height and projection of the new unit, traffic signals will no longer have to compete with neon igns and other bright lights for drivers' attention. The increased height of the newly-installed traffic signal also eliminates its obstruction from view caused by buses and trucks.

The 20-foot long arms curve gracefully over the roadway diagonally from the corner and support standard three-color signals. The mast arms make the signal so conspicuous that we say that 'it looks for the driver instead of making the driver look for it".

For Heavy Traffic Areas

Primarily designed to increase traffic safety in areas having a heavy concentration of vehicles, the long mast arms allow the post to be located out of existing pedestrian crosswalks and still have the traffic signal extend a minimum of 6 feet beyond the curb line into both streets. By varying the angle to which the arm is turned, the signals may be adjusted to the best needs of the intersection.

This new type unit, which consists of a 20-foot high vertical shaft and a 20-foot curved mast arm, is made of a special low alloy, high tensile steel which is designed to withstand storm velocities of more than 100 miles an hour. In addition, the unit is corrosion-resistant because of the addition of copper and nickel in the alloys and needs little maintenance.

The installations were designed by the Planning Division of New York City's Department of Traffic to combine attractive appearance and greatest convenience for the motorist. Standards and mast arms were manufactured by Vulcan Steel Products Company; Marbelite Company furnished the three-color signal units.

These mast arms are the first of 350 to be installed on some of the most heavily travelled arteries in New York City. It is expected that the increased signal visibility will result in increased safety for both motorists and pedestrians.

● **FIRST installation of the new 20-foot signal mast arm supported by a 20-foot standard. This arrangement gives increased visibility to both motorist and pedestrian by moving the signals away from a background of lights and neon store signs.**

Radio-Controlled Traffic Lights

Radio-controlled traffic lights, said to be the first of this kind, are planned for Chicago. In the beginning, thirteen intersections will be radio-controlled, with the antenna on top of a building near the business area. Traffic lights will be set to favor the prevailing flow of traffic at particular times of day. The cost of the initial radio installations will be $40,000. Leslie Sorenson is Traffic Engineer.

Selling an Abandoned Airport

Over the next 10 years, Pueblo, Colo., expects to realize about $1 million from sale of the 700-acre abandoned airport site. It is estimated that the city will net $1,500 per acre after installing sewers, paving, sidewalks, and curbs in the 155 residential building sites initially put on the market. Local real estate men will handle all transactions and receive a 10 per cent commission.

● **HIGH ALTITUDE specialist of Jack Ammann fleet is this converted P-61 twin engine "Black Widow."**

Topographic MAPPING Pays Off for DALLAS

DALLAS, Texas, has been for many years one of the fastest growing cities in America. Its strategic location, financial facilities, excellent rail, highway, and air-transport connections, plus a progressive civic spirit and fine year-round living conditions have been responsible for this phenomenal growth.

But with this growth, welcome as it has been, came the inevitable landslide of problems that accompany the expansion of any metropolitan area. Water and sewerage facilities and other utilities rapidly became overtaxed. New street construction boomed and it became necessary to redesign many existing thoroughfares to accommodate the increasing traffic load. Annexation of newly built subdivisions developed into a major problem. The City Tax Department found itself faced with a formidable task in keeping abreast of new taxable property. And so it went through every department in the City Government, each suffering its own particular type of growing pain. But, widely varied as the problems were, one thing became apparent—each department experienced a definite need for a complete set of accurate, up-to-date topographic maps of the entire City and also for a considerable surrounding area.

Under the guidance of Marvin Springer, Dallas' City Planning Engineer, the various City Departments worked out a set of requirements for the mapping. It was decided that a set of maps at a scale of 1 in. to 200 ft., showing contours at an interval of five feet would provide the solution to the problem. An area of approximately 340 square miles in and around the City was to be included in the program. It was decided by the City officials that the mapping should be conducted by photogrammetric methods due to the very considerable savings in money and time afforded by this method as compared to mapping by conventional ground survey methods. Accordingly, negotiations were opened with Jack Ammann Photogrammetric Engineers of San Antonio, Texas, and a complete set of detailed specifications were prepared by the City's engineers in cooperation with the Jack Ammann firm. After these negotiations were completed the program was placed before the citizens of Dallas in the form of a proposed bond issue. The bond issue was approved by the voters and Dallas was on its way to being the best-mapped City in the United States.

The entire area was photographed with a precision mapping camera flown at a constant altitude—actually, the area was re-photographed later during the project to insure up-to-date detail—and, after completion of the necessary field control surveys, production of the topographic map sheets was begun on a priority system set up by the City. Thus, the "hot spots" were mapped first and the less critical areas were held off until later in the program. As the individual map sheets were delivered, the City subjected them to rigid inspection for accuracy and completeness as set forth in the specifications. None of the 394 sheets covering the area was rejected or required even minor correction and the maps were put into immediate use.

Uses of the Maps

One of the first uses of the new maps was in the location of a proposed expressway. The City Zoo presented a formidable obstacle in that the proposed location projected the highway through it. As it was not practical actually to run the highway through the Zoo, the City engineers began studying the new topographic maps of the area and found that the topography of the ground lent itself very well to the construction of an elevated highway over the Zoo. The solution thus afforded proved to be economical, practical, and required no significant change in the Zoo grounds.

The City of Dallas wisely elected to map a large area outside the existing city limits as it was realized that annexation studies and drainage studies would be materially aided by the possession of map information well outside the actual city limits. The wisdom of this decision is already apparent. Many cities, Dallas included, have in the past annexed areas without the complete knowledge of the terrain afforded by accurate topographic maps and have learned too late that the extension of water, sewerage and other utilities into the annexed area will cost far more than originally estimated, thus making the annexation a decidely unprofitable undertaking. This unfortunate possibility will not again plague the planners and engineers of Dallas. With complete topographic information on all areas which might affect their planning they are in a position "to know where they are going" at all times.

Another utilization of the maps was made in the planning for the conversion of Ledbetter Drive, a major, heavily traveled artery, into an expressway. The detailed planning of this conversion involved a great number of complex engineering problems, including the design of a number of interchanges in a heavily built-up area and the problem of maintaining traffic flow on cross streets which do not have direct access to the new expressway. As the first step in attacking this problem, personnel of the City Planning Department prepared, from the individual topographic map sheets, a strip map of the entire proposed construction. By using this strip map the engineers were able to draw up detailed design plans without conducting any costly, time-consuming field surveys. One city official observed that, in his opinion, this one use of a very few of the maps saved the city as much money as the entire mapping program cost. This strip map also proved invaluable in presenting the overall program to the City Council, the Chamber of Commerce, and other interested organizations.

These are but a few of the uses to which the City of Dallas will put their topographic maps. They will be used widely in the Water Department, Sewer Department, Recreation Department, Tax Assessor's Office, Traffic Department, and City Planning Department, to mention a few. Already many private firms, such as consulting engineers and real estate developers, are calling upon the City for copies of the maps. The advantages of possessing a complete set of accurate topographic maps are now being realized and this realization will continue to grow as time passes.

It all adds up to this—Dallas has taken another stride forward in its determination to maintain its position as one of the great cities of this country.

● **RAPIDLY** expanding residential development in the Dallas, Texas, area is typified by this pair of aerial photos.

● **PICTURE** at left was made in March, 1951. Photo above, made in January, 1953, shows many new streets and homes.

● **EXPRESSWAY** planning and construction is assisted by aerial photographs and maps. This photo was made in 1947.

● **FIVE** years later, in 1952, the completed expressway may be seen. This pair of photos were made in San Antonio.

APWA News

AMERICAN PUBLIC WORKS ASSOCIATION
1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

New Specification on Soil Cement Roads and Streets

A new edition of another of a series of the Association's Standard Construction Specifications has just been issued. This new Specification H—Soil Cement Roads and Streets—is a revision of an earlier edition which was first published in 1950. It was prepared by a committee composed of the following members: J. A. Leadabrand, Manager, Soil Cement Bureau, Portland Cement Association, Chicago, Illinois (Chairman); Alden K. Fogg, City Engineer, San Diego, California; R. L. Oldham, Chief Engineer, Hasie and Green, Consulting Engineers, Lubbock, Texas; D. T. Grider, Supt. of Public Works, Columbus, Georgia; H. F. MacKay, City Engineer, Wheaton, Illinois and C. L. Watkins, Director of Public Works, Alexandria, Virginia. Copies are available to non-members of the Association at the price of $1.00 each.

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Economy in Public Works Operations

Condensed from a paper presented by William R. Smith, Consultant in Public Administration and Industrial Engineering, before the Southern California Chapter of the American Public Works Association.

ECONOMY is always an intriguing subject. To relate it to the public purse makes it even more so. Economy in the varied and numerous public works operations has a great impact on the everyday living of the people in the community.

We know all about the extent and gravity of the services of public works. We also know most of the ways for operating economically. But it would be dishonest to contend that we keep these things constantly in mind. It is worthwhile to jog memories by restating some of the more essential measures for economical operation.

Topping the list of economy musts are things such as —(1) engineering the job, (2) planning cooperatively, (3) searching out the most economical method, and—(4) using meaningful cost criteria for making plans and exercising control.

The functions of public works are akin in a number of respects. The first place where they meet on common ground is in the requirement for engineering the job. The need for job engineering is usually recognized but not always ahered to. The experience of a western city provides a good example of where engineering laxity resulted in wasted dollars. This city decided to undertake a cut and cover program for disposing of its refuse. The new operation at the site was actually underway before it was discovered that less than four feet underground there was solid rock. There was no other property available, so the city continued to use its shallow site. Today, the area is almost exhausted, and the city has no other site in view.

Cities are not the only agencies that slack off on engineering requirements. Where there are large organizations employing sizeable engineering staffs and several construction crews, the paper work in between often seems insurmountable, with the result that work may run afoul of a drainage problem, other installed service facilities or substandard soil conditions.

Again money is wasted in rework. By all means jobs should be right—at the beginning—on the drafting board. This can be accomplished by strict adherence to a few rules.

(1) Make known the importance of engineering the job all down the line, and obtain acceptance of the idea.

(2) Employ an engineering staff that is job-tested.

(3) Clear the channel running from the engineer to the crew.

(4) Hold off construction until the specifications are complete, except in emergencies, and the need for classifying situations emergencies should be carefully scrutinized.

It is not uncommon for as many as three separate agencies to be involved in the same project—the city's engineers and inspection department, the utility companies' right-of-way people and construction crews and the contractors' engineers and equipment operators.

More important than the lead horse on this team is the *desire* by everyone to let the other person in on the plans at the start *and* to keep him in until the job is completed. Costs become excessive when the operating plans of these people are not sufficiently coordinated to prevent unnecessary pole moves and repeated tearing up of the pavement.

In public works the greatest savings are to be found in the improvement of the operating methods themselves. Purchase of the right piece of equipment, proper utiliza-

tion of the equipment and the scheduling of personnel and machines for maximum output—these are methods of operation.

In this area there is a city which is about to achieve real economy, running in the high five figures for every year. We are concerned here with one of the most pressured of all public works functions—rubbish collection. Much of the significance in this case lies in the city's desire to operate more economically, and the determination it has shown in sticking to this desire through a period of difficult readjustment.

Involved in the new program are several fundamental changes in methods, namely the use of new compaction collection trucks; revised routes and pick-up schedules; realignment of collection crew assignments; improved specifications for containers; and a major change in the final disposal operation.

How did these moves build up the substantial cost reduction figure mentioned earlier? By bringing about such economies as reduced personnel, fewer miles driven, with smaller costs for fuel and repairs, and better utilization of city property.

Equipment Fleets

Still on the subject of searching out the most economical method, there is another area where public works administrators have an opportunity for less expensive operation. This is in the handling of the equipment fleet. Cars, trucks and other items of equipment constitute a large investment that in some organizations runs into the millions of dollars. The economy-minded public works operator takes steps to protect this investment:

(1) His equipment is designed correctly in the first place, a careful analysis having been made on how the item was to be utilized.

(2) Lubrications and oil changes are made at regular intervals, regardless of how badly the vehicle is said to be needed on the job.

(3) Unless the organization owns a large quantity of equipment, all but minor repairs and preventive maintenance are done by an outside garage. Even with a large operation, it is well to consider an outside garage for most of the work. There is a tendency by the public works department to do too much of its own automotive maintenance.

(4) Only the equipment that is needed is installed in the public works shop. It is of late design and well kept up. Also, there is good lighting and ventilation.

(5) It is recognized that there is a correct replacement time for every vehicle. Whether it be based on function, age, driving miles, hours operated, obsolescence, or a combination of these, each vehicle is retired at the time its resale value compares favorably with its continued usefulness.

Another measure for stressing economy in operation is to use meaningful cost criteria for developing plans and exercising administrative control. It is a fairly easy task to determine the cost per ton for collecting refuse and operating the municipal incinerator, the square yard cost for surfacing streets, and the cost per square foot involved in constructing sidewalks. There are a number of other operations whose costs can be measured rather accurately in terms of production units such as lineal feet, cubic yards, and cleaning miles. This kind of information, which is usually based on cost experience, is a big help at budget time to those organizations which have put forth the effort to develop it. But the conversion of construction plans into construction costs is only part of what cost criteria can do. Once the budget is established, regular comparison should be made between what is actually spent and the cost criteria used in preparing the budget. By this means variances will be highlighted so that their causes can be determined.

These are four of the principal ways to economize in public works operations—engineering the job, planning cooperatively, searching out the most economical method, and using meaningful cost criteria for plans and exercising control.

However, before any economy measure can be successfully carried out, the attitude of the public works people towards economy must be right. They must want it, and be determined to work constantly for it.

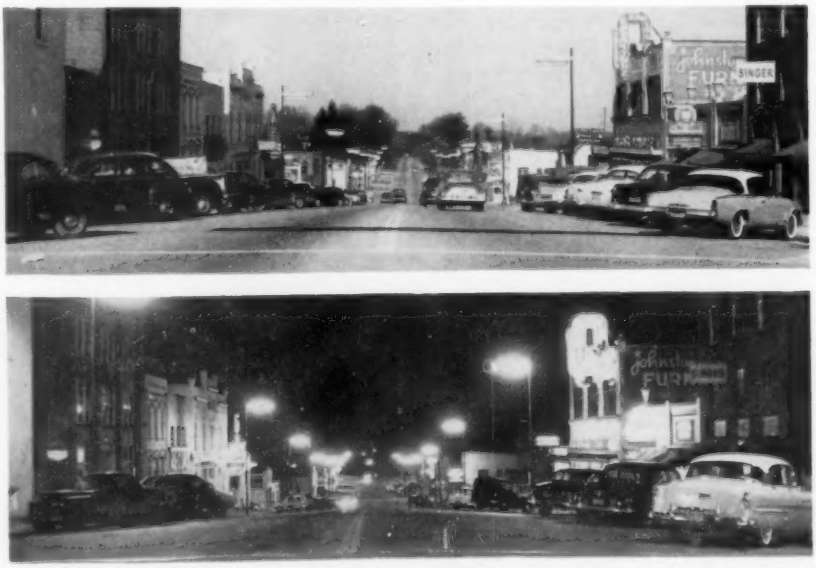
Fluorescent Street Lights Please This Community

JAMES A. STEWART
Supt., Water & Light Dept.,
Statesville, N. C.

LIGHT WITHOUT glare, but illuminating the whole area like day; penetrating rain and fog, but not producing a glare on wet streets, was what Statesville got with the purchase and installation of 104 General Electric F 206 21,000 lumen fluorescent street lights. These were installed in the business area. The lights were staggered, 145 feet apart, and mounted 30 ft. above street level. Installation was by the City Light Department's regular crew at the rate of 30 per day complete, after the bases were poured.

Though the cost of fluorescent lights is somewhat greater, this extra cost was considered well worth while. Consideration was also given to incandescent, mercury vapor and mercury vapor color-treated lamps for this installation.

The merchants in Statesville are well pleased with the fluorescent lighting because it reveals the natural color of their merchandise.



● **NIGHTTIME illumination nearly matches daylight on Statesville's main street.**

Washington news

Presented in cooperation with the American Public Works Association and through the courtesy of the Washington Office of the American Municipal Association.

Congress Considers New Highway Bills

The President submitted a Special Message to Congress on Feb. 22 in which he pointed out that recent highway studies provide—"inescapable evidence that action, comprehensive and quick and forward-looking, is needed". He further stated that the highway needs study made by the Bureau of Public Roads at the direction of the Eighty-third Congress and the Clay Committee Report which he transmitted to Congress provide what he called—"a solid foundation for a sound program".

S.1160 embodying the President's recommendations was thereafter introduced in the Senate under the names of Senators Francis Case of South Dakota, Edward Martin of Pennsylvania and Dennis Chavez of New Mexico. At the same time a companion bill H.R.4261 was being introduced in the House. These bills authorize the creation of a Federal Highway Corporation which would issue $25 billion worth of bonds to finance the complete cost of modernizing the Interstate system over a period of ten years. The Senate subcommittee on Roads is now conducting hearings on S.1160 and S.1048. The latter bill was introduced by Senator Albert Gore of

(*Continued on page* 170)

Public Construction Activity

Combined resources of the U. S. Departments of Labor and Commerce have resulted in a new compilation of public construction activity in the U. S. for 1929-1954. Following is a chart showing the situation:

New Public Construction Activity, 1929-1954

Figures Show Value Put in Place in Millions of Dollars

YEAR	ALL PUBLIC CONSTRUCTION	FEDERAL		STATE AND LOCAL
		Direct	*Federal Aid*	
1929	2,486	155	80	2,251
1930	2,858	209	104	2,545
1931	2,659	271	235	2,153
1932	1,862	333	111	1,418
1933	1,648	516	286	846
1934	2,211	626	721	864
1935	2,233	814	567	852
1936	3,516	797	1,566	1,153
1937	3,096	776	1,117	1,203
1938	3,420	717	1,320	1,383
1939	3,809	759	1,377	1,673
1940	3,628	1,182	947	1,500
1941	5,751	3,751	697	1,303
1942	10,660	9,313	475	872
1943	6,322	5,609	268	445
1944	3,073	2,505	126	442
1945	2,398	1,737	99	562
1946	2,362	870	244	1,248
1947	3,433	840	409	2,184
1948	4,825	1,177	417	3,231
1949	6,405	1,488	461	4,456
1950	7,000	1,625	465	4,910
1951	9,418	2,982	479	5,957
1952	10,901	4,186	619	6,096
1953	11,379	4,153	700	6,526
1954	11,450	3,423	706	7,321

For "ownership" combine "Federal-aid" and "State and Local" columns to obtain State and local ownership. "Direct" column stands as it is for Federal ownership.

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Stabilization with Emulsified Asphalt

C. A. PETERSON,
Director of Public Works,
Pinellas County, Clearwater, Florida

HIGH quality road building material is available only from sources located 100 to 700 miles from Pinellas County. The present freight rates are prohibitive. This situation precipitated an investigation into the possible use of locally available materials. The investigation disclosed that such material could be economically used on certain projects provided that controlled laboratory operations were available at all times. Materials available within Pinellas County are: Sand-loam, shell-marl, beach sand (pumped in fills) and oyster shell.

The sand loam is general within the county. The bearing value is low—about 15 pounds per square inch—so an additional mixture must be added. This may be shell, marl, oyster shell and emulsified asphalt. Shell-marl can be used successfully as a base material providing the base is dry. Oyster shell is available in large quantities and is used extensively. The beach sand mentioned is obtained from pumping operations, and is usually used wherever a finger has been constructed into the Bay. This material also carries a low bearing value which means an addition of the proper material to raise this value.

Minimum specifications for street development on county roads have been set up as follows:

A developer must submit a letter stating the type of pavement anticipated, which shall comply with one of the approved types: 1. Mixed-in-place bituminous pavement with mineral seal coat. 2. Lime rock base with double surface treatment. 3. Lime rock base with retread surface. 4. Lime rock base with single surface treatment and plant mix wearing surface. 5. Oyster shell base with single surface treatment and P.M. 6. Stabilized lime rock base with double surface treatment. 7. Stabilized lime rock base with single surface treatment and P. M.

Along with this letter the developer must submit plans and profiles showing alignment, grades and drainage arrangements, taking into consideration the adjacent property. All technical and testing services for the proper construction are chargeable to the developer.

The construction method for sand bituminous road mix using emulsified asphalt is as follows:

Manual Mixing: The base aggregate is prepared and approved; then the emulsified asphalt is applied uniformly at a rate of 0.5 gallon per square yard or as directed by the Engineer until the specified amount has been applied. Manual mixing is done with blade grader, harrow or Seaman Pulvi-mixer. Mixing is continued until all aggregate particles are coated with bituminous material.

Plant Mixing: Under this method, mixing has been done using a Wood mixer. The Wood windrow evener was used to obtain uniformity of the windrows. Emulsified asphalt was handled through the asphalt pump and mixing drum. The amount of asphalt used has varied from 0.5 gallon to 0.75 gallon per square yard per inch of thickness. The exact amount is determined by the testing laboratory at all times.

Finishing: After the mixing has

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been completed, the mix is allowed to cure until it has reached the proper consistency to be compacted. It is then aerated with the pulvimixer or grader and laid out into 2-inch layers. The first layer is compacted using a pneumatic-tired roller and then this procedure is repeated until the specified thickness of pavement is obtained.

Other projects under construction during the last three years have been handled with other base materials such as beach sand and oyster shell. Many of these projects are so located that the most economical material to be used is oyster shell. The construction procedure for this type of road is as follows:

After the sub-base has been stabilized, oyster shell is spread uniformly and then compacted to the specified density. The entire surface is then scarified, watered and re-rolled to the proper crown. The completed base course is then opened to traffic for a sufficient period of time to allow the base to become thoroughly cured before the prime and/or wearing surface is laid.

After the completed base has been primed a wearing course is constructed using bituminous material and limestone or slag mixed in place, machine laid on the prepared base. In most cases a tack coat is not used, and we have proven that our machine mix material will bond satisfactorily at all times.

The wearing course is applied using a Hetherington & Berner Moto-Paver at a rate of one cubic foot, loose measurement of grade #13 stone mixed with from 0.6 to 0.8 gallon of emulsified asphalt per square yard. A mineral seal coat is then added using approximately 0.15 cubic ft. of grade #18 stone mixed with approximately 0.2 gallon of emulsified asphalt per square yard.

On several secondary county roads a double surface treatment has been applied on the prepared base. This bituminous surface treatment is composed of approximately 0.6 gallon of emulsified asphalt (quick setting) in two applications; it is covered with approximately 0.75 cubic ft., loose measurement, of cover material per square yard. The two applications of asphalt were approximately 0.25 gal. psy for the first and 0.35 gal. psy for the second application. The cover material was placed in two applications, one of grade #11 and one of grade #15. The proportion of

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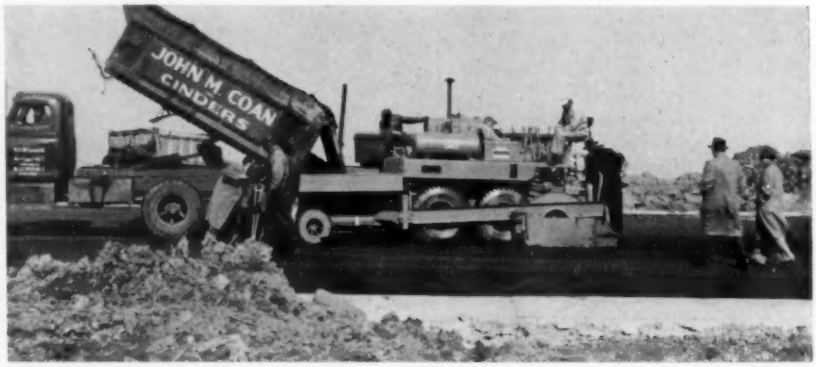
coarse to fine material was approximately 2 parts of coarse for the first application to one part of fine for the second application.

We have just completed 6 miles of Moto-Paver laid wearing course using slag with emulsified asphalt (Mixing Grade), adding a small amount of cement, heating the asphalt to 125 degrees, rolling once over lightly within two hours and then dry sealing, using ¼" #10 slag. This was then re-rolled to final acceptance. The job looks very good and we expect to do more of this type of work immediately.

The 1955 program consists of 15 projects which include ten miles of new construction, 5 small bridges and several drainage projects. We have come to the conclusion that using emulsified asphalt with the local sand and shell is the most economical base material for Pinellas County. All of the retreads, wearing surfaces, and double surface treatment projects will use emulsified asphalt exclusively.

This is an abstract of a paper by Mr. Peterson at the 1955 meeting of the American Road Builders Association.

Paver Lays 24 Feet per Minute of a 12-Foot Lane



● **DELIVERING a load of hot mix to Blaw-Knox bituminous paver operating on highway improvement project in Cook County, Ill. Here paver places finish course.**

DESPITE delays in hauling the hot mix, due to heavy traffic, a Blaw-Knox bituminous paver laid 12-ft. courses at an average rate of 24 ft. per minute on Chicago's program for moving loop traffic to the Lake Shore Drive. The job involved two roadways half a mile long and 48 ft. wide. The base of crushed stone was spread with a blade grader and topped with two courses of bituminous base, Illinois I-11, each 1½ ins. thick, and with an I-11 surface. The roadways were laid in 12-ft. lanes. Hot mix was delivered in 10 to 15-ton batches from the plant 12 miles away. Mix temperature at the plant was 320° and on arrival at the job after the long haul it was 270°.

Standby Power and Overflow Prevention for Sewage Pumping Stations

DEVELOPMENT of residential areas on the watersheds and near the reservoirs supplying water to Baltimore City and the Baltimore County Metropolitan District, presented a serious problem. Since the discharge of even so-called "fully treated" sewage into the reservoir was not permitted, it was necessary to install sewage pumping stations and remove the sewage from the watershed. Accordingly, such stations were constructed, but the development of the areas was so rapid that overflow problems arose.

Periodic power outages at the new Greenridge pumping station resulted in overflow of raw sewage although the maximum power outage was only 18 minutes. In one case, however, the station was out of service for 18 hours because a phase fuse was blown. Although the remaining phases were sufficient to sustain the motor in operation, they could not start them once the motors had stopped. The indicator lights did not show the outage and the trouble could not be readily located.

Though an auxiliary storage tank was added at the station to retain a 30-minute average flow, continuing

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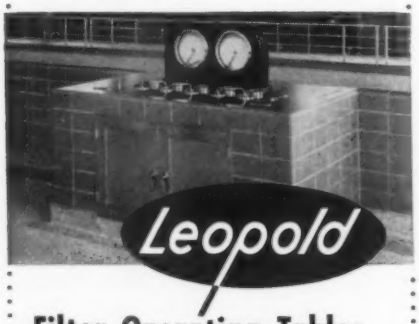

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outages and overflow at this and other sewage pumping stations proved conclusively that additional protection was needed. As a result, design and maintenance criteria were established at a meeting of representatives of the Baltimore City Bureau of water supply and Bureau of Sewers; the Baltimore County Metropolitan District; the State Department of Health; the Consolidated Gas, Electric Light and Power Co.; and the consulting engineers. At this meeting the following policy was adopted:

Outline of Policy

1. Standby power for both existing pumping stations and all future stations is to be provided. This power is to be in the form of an emergency gasoline engine located at the station, or an independent power line from another Gas and Electric Company sub-station forming a loop.
2. Red and green lights are to be installed which are visible from the outside, so that personnel passing by can tell whether the pumps are running or not. The lights are to be so wired that they will not light if any phase of the power supply is out.
3. High-water alarms are to be installed on all units which will notify personnel at the Towson yard of any undue rise in the sewage level by means of a telephone relay.
4. Storage capacity is to be built into any wet-well greatly in excess of that generally provided so that maintenance forces will have time to act before an overflow occurs.

Policies were also adopted in reference to maintenance. After each electrical or other major storm a Metropolitan District employee visits each station to make sure there is no damage. While at the station he signs the 24-hour pumping chart to serve as assurance that the station was visited and to note the time of the visit. The Metropolitan District notifies the Bureau of Water Supply immediately after every service stoppage, and the Gas and Electric Company places a top priority on the inspection and repair of lines to these stations after storms.

At Greenridge pumping station an auxiliary storage well was built in the form of a brick vault on the east side of the station to provide a total of 30-minute detention in the wet-well. As the sewage level in the station wet-well rises beyond normal high-water the sewage flows into the storage well through openings between the wells. Except for these openings the two wells are

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entirely separate and the storage well is accessible through a manhole outside the station.

In spite of the storage well the station was out of service several times for sufficient time to cause an overflow from the station. As a result the maintenance forces of the Metropolitan District plugged and abandoned the station overflow and installed watertight manhole covers on the outfall to the station to prevent such overflows.

As a result of these experiences, it was decided to install gasoline engines using right-angle drives for emergency use, these to operate one pump only, since either pump can carry the peak load.

One problem of pump installation was the cooling system. The most obvious method was a radiator mounted directly on the engine but sufficient cooling air is not available in a small building and bringing air in from outside is difficult. Air ducts are bulky and require a large structure. Fixed-open louvres increase the station heating costs and automatic louvres sometimes fail to operate. If the radiator were located elsewhere, a fan and motor would be required and no power is available when the fan is needed. Use of a heat exchanger was investigated but proved too costly. The final decision was to use water from the muncipal supply to cool the engine from which it flows to water-jacket on the exhaust, then to waste in a floor drain. The supply is controlled by a solenoid valve operated by the 6-volt power supply from the engine and actuated by the thermostat.

The fuel storage is in a tank located in a brick vault and encased in sand just outside the building at the same elevation as the engine so that no pumping is required since the maximum lifting capacity of the carburetor is about 5 feet. The brick vault and sand encasement are required by the fire code.

The pump motors are actuated by electric-probe controls indicating high- and low-water levels. During a power outage these electric probes will not function and a float tube and mechanical switch are provided to start the gasoline engine. The engine control is automatic and the engine starts when the power to the station fails and the level in the wet-well rises to the limit at which the electric motors normally start.

Several methods of providing the additional storage capacity were studied. Among these were a large wet-well within the station proper; a large box sewer on the incoming sewer; or an oversized circular sewer in place of the last section of the interceptor to the station. The last method was chosen for several reasons. The size of the structure would not be affected; the sewer, being circular, is self-cleansing and does not have to be washed after each time it is used; and the construction was more economical. In the future, when flows increase the storage capacity can easily be increased by replacing more of the interceptor with oversize sewer or by building a parallel sewer without affecting the building.

The data in this article are based on the excellent 1953 report of the Maryland Division of Sanitary Engineering, of which George L. Hall is chief; on a personal communication from Mr. Hall; and on a paper prepared by William F. Neale of Whitman, Requardt & Associates, consulting engineers, which appeared in the 1953 Proceedings of the Maryland-Delaware Water and Sewage Association.

How Far Can Two-Way Radio Reach?

An abstract of an article in the Motorola Newsgram

FROM an engineering standpoint, it is technically sound to state that reliable communications can be maintained within a radius in excess of 18 miles around a 160 mc. 60-watt base station with a 100-foot antenna tower over normal rolling terrain. This generalization is invalid for any variation from normal expectations. On the other hand, many systems are operating today with ranges of two to three times this distance. It takes a comprehensive survey to arrive at a figure which the engineer is willing to guarantee.

Field Tests—One method of arriving at a reasonably correct range estimate is by a comparison of the proposed system with like systems operating under the same conditions. A second method is to set up an actual test installation, simulating the proposed installation. If the test installation is a duplicate of the final installation, and if a sufficient

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number of tests are made, accuracy in prediction can be obtained. For convenience in data evaluation the collected data can be plotted in the form of signal strength contours on any standard map.

Frequently it is technically and economically impractical to conduct a full-scale survey. In such cases where an abbreviated survey is inadequate, an engineering study on paper is employed.

Propagation—VHF radio, for the most part behaves like light. The radio beam travels in a straight line but is subject to reflection, refraction and diffraction. Local conditions determine what the maximum range will be. Among the factors which must be included in an engineering analysis are: topography, geology, man-made and natural obstacles, foliage, transmitter power, receiver sensitivity, antenna height, antenna gain, antenna directivity, transmission line losses, noise, interfering signals and space attenuation. Additional factors such as "skip" must be considered although not necessarily included in calculations.

Radio Horizon—As a basis for calculations, transmitter effective radiated power (chassis output plus antenna gain less losses) and effective receiver sensitivity (chassis sensitivity for reliable communications plus antenna gain less losses) must be used. As an example, a transmitter power of +18 dbw. (60 watts) and a receiver sensitivity of —138 dbw. (1 microvolt) will permit propagation losses up to 156 db. while retaining reliable communications. Free-space attenuation charts and tables are supplemented by data on relative topography and radio horizon to correlate propagation losses to range.

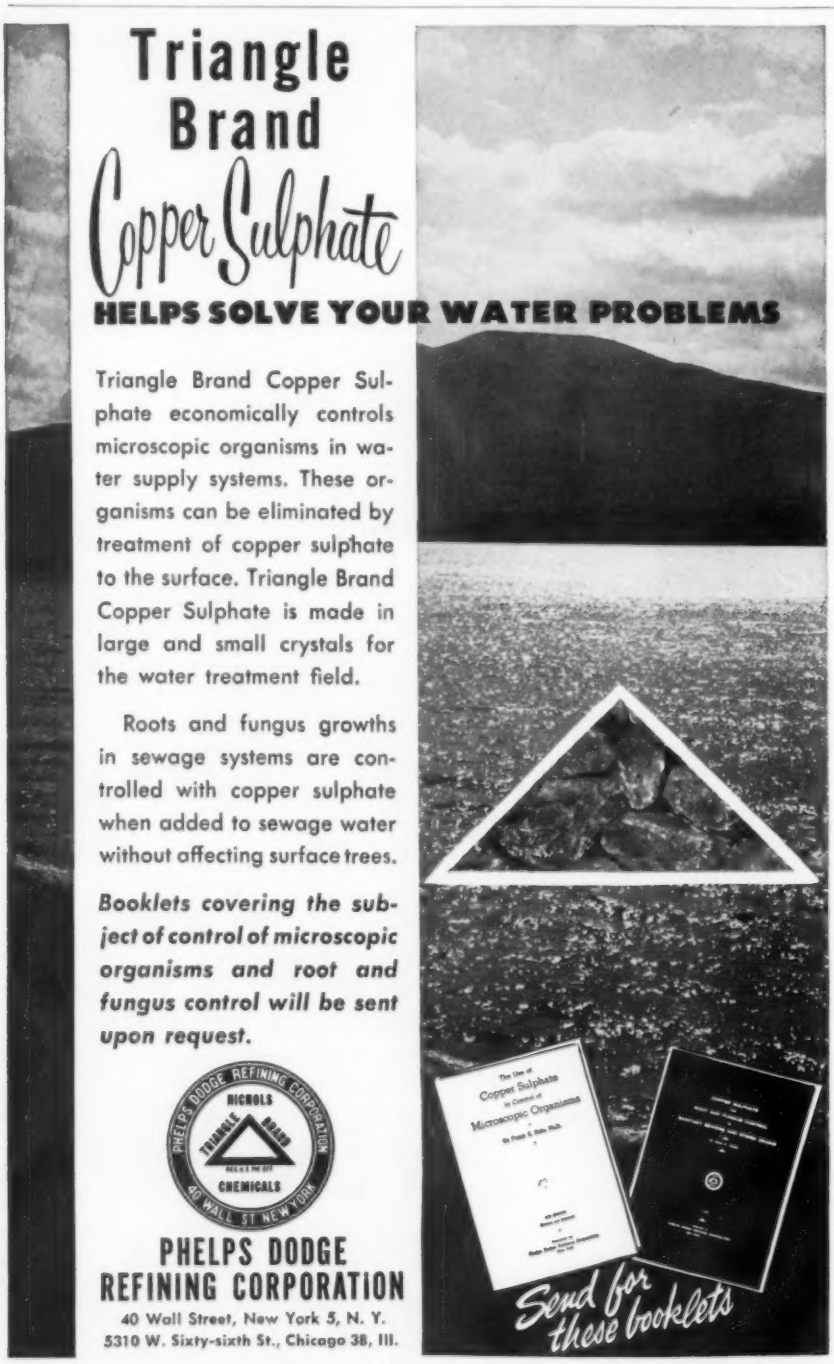
Diffraction tends to extend the radio horizon beyond the visual horizon. Accumulated experience has shown that at the lower frequencies a realistic range figure is obtained by using a theoretical earth radius which is 133 percent of the true earth radius. At higher frequencies (450 mc. and above), this 4/3 earth radius is no longer as accurate, and "true" earth radius plus Fresnel zone charts are used.

Profile—Using a graphical form which presents height above ground on a vertical scale and earth curvature on a curved horizontal distance scale, a profile of the radio horizon can be easily plotted. This pictorial representation of the corrected line-of-sight path shows clearly not only the radio horizon, but the "shadow" effects of natural and man-made objects as well. From a number of these profile charts for important radials from the transmitter site, data can be transferred to a signal strength contour on any common map. Even though this type of analysis is reasonably accurate and conservatively correct, it cannot and does not include all of the effects of natural phenomena which accompany VHF radio propagation.

Propagation Effects—Radio signals, particularly at lower frequencies, can be reflected from a layer of ionized air in the upper atmosphere and "bounced" back to earth hundreds or thousands of miles away. This "skip" effect is constantly changing and cannot be relied upon to provide dependable communications; it may be considered in a negative sense as an interference possibility.

"Forward scattering" wherein high powered transmitters and highly directive antennas beam signals beyond the normal radio horizon is currently in the stage of investigation and may prove useful in the future. Similarly, higher than normally expected coverage behind high sharp ("knife-edge") obstacles is undergoing study.

Reflections from solid objects can both add to and subtract from ex-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pected range and are difficult, if not impossible, to predict on paper. In cities, the multiple reflections from buildings, particularly at the higher frequencies, help to "fill in" the coverage gaps behind buildings and under bridges out of the line-of-sight path. In the canyons of mountainous areas it has been found that reflections "bouncing" between the canyon walls can materially increase the range beyond expected line-of-sight paths. However, in any system which has multi-path multiple reflections, some "dead" spots can be expected regardless of the equipment used.

Foliage, particularly damp or wet leaves on trees, will tend to absorb radio signals. The higher frequencies will suffer the greatest attenuation. Thus, in densely wooded areas, coverage will be greater in fall and winter than in spring and summer.

Interfering signals which fall in the receiver passband, regardless of their origin, must be considered in the evaluation. This includes the spurious and harmonic output of nearby transmitters, receiver spurious and image response as well as intermodulation and desensitization.

It must also be remembered that the lower frequencies have antennas which are physically longer for a given electrical wave length and hence, intercept more of the electric field (microvolts per meter). For a given field strength, the lower frequency antennas induce more microvolts of signal into the receiver. This, coupled with the fact that it is possible to build more sensitive receivers at the lower frequencies, contributes substantially toward the longer range obtained on the lower frequency VHF bands.

Power—Transmitter power output and communication range are not directly proportional in the typical VHF system. The variable effects of terrain signal absorption especially beyond "line-of-sight" distance from the base station essentially destroys the inverse square law of signal attenuation achieved in free space.

All of the preceding statements have been directed at base-to-mobile communications. It must be noted that the communications range between mobile or portable units will necessarily be less because of generally lower power and lower antenna heights.

It is obviously impossible to point to a two-way radio unit and make an unqualified statement about its range. As stated above, the maximum range is generally considered to be the radio horizon, but there are other contributing factors.

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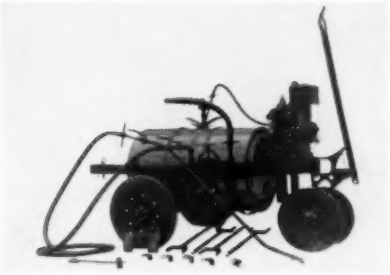

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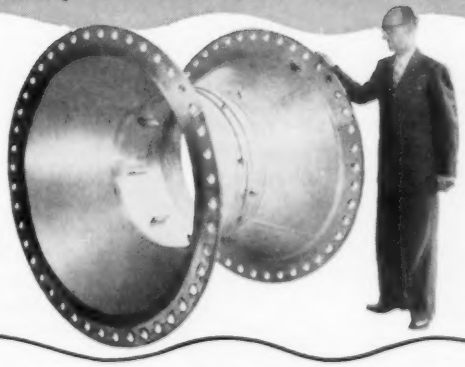

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A Critical Evaluation of Municipal Composting

LINVIL G. RICH,
Associate Professor of Sanitary Engineering,
Virginia Polytechnic Institute

MANY municipal officials are considering composting as a solution to current refuse disposal problems. Their interest has been aroused by the intriguing possibility of making a profit out of a material, the disposal of which is becoming increasingly more costly. The author was one of a committee asked to study a composting proposal recently submitted to a Virginia city. In the process of evaluating the current status of composting municipal refuse, several interesting and inescapable facts came to light. These should be an aid to municipalities now considering similar proposals.

Composting is not new. For centuries farmers have piled manure and other barnyard wastes in heaps to produce, months later, a humus-like material with fertilizer properties. In many parts of the world today, farm compost plays an important role in agriculture. Composting municipal wastes, however, is a recent development. European cities first employed the process for disposing of community garbage soon after World War I. Although the European practice was considered successful, American communities did not seriously consider composting of municipal refuse until World War II. The shortage of inorganic fertilizer from 1940 to 1945 increased the value of compost as well as all organic fertilizers.

Composting is merely the conversion of putrefactive organic matter by micro-organisms into a stable end product useful as an agricultural humus. Composting processes may be divided into two general classes—those in which stabilization is achieved through anaerobic

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decomposition and those in which aerobic decomposition predominates. Whereas anaerobic methods require months to produce compost, the aerobic processes are more rapid, yielding compost in a matter of days or a few weeks at the most. Processes designed for the compost of municipal refuse are aerobic and thermophilic (carried out at elevated temperatures).

The fundamental steps for large scale composting of refuse include (a) removal of non-compostables; (b) grinding; (c) placing for composting; (d) turning or aerating; and (e) regrinding and bagging or storing in bulk for sale. Composting may be carried out either in digesters or in open-air piles. Results of studies made at the University of California indicate that the microorganisms necessary to initiate the composting process are already present in the raw material and, therefore, inoculation by special cultures is entirely superfluous. (1)

Economic Value of Compost

Preliminary to the proper evaluation of composting as a disposal method, an investigation must be made of the commercial value of compost. To date, only a limited quantity of compost has been produced commercially. That which has appeared on the market has sold in small lots at relatively high prices. Compost produced by the Oakland compost plant and distributed by the Ferry-Morse Seed Company sold for $4.00 per cwt. (2) Frazer Products, Inc., advertised compost from a plant at Mt. Wolf, Pennsylvania, for $6.00 per 80 lb. bag. (3)

Actually, compost has not yet been marketed in quantities sufficient to effect a stable price. It is necessary, therefore, to predict the price compost will command, when and if the market is established, by investigating the current worth of materials against which it would be expected to compete.

Compost has been described as a fertilizer and soil conditioner. Plant food values of several popular fertilizers and soil conditioners are shown in Table 1. Compost has the least plant food value of all materials listed. Furthermore, if it is assumed that compost would retail at $4.00 per cwt. (a price comparable to that of farm manures marketed in similar quantities for home-gardening), then, on a per pound of plant food basis, compost would be the most expensive. Obviously, compost cannot compete on the market as a fertilizer.

Soil conditioners are employed to improve the physical texture and the moisture retentive properties of soil. Farm manures, peat, and dried sewage sludge are popular soil conditioners. Presumably, compost could compete with these materials as a soil conditioner.

Inasmuch as sewage sludge, too, is a by-product of disposal, the price structures of three sludges have been selected as bases for predicting

TABLE 1 — Composition and Prices of Fertilizers and Soil Conditioners

	*Approximate Fertilizer Grade**			*Approx. Retail Price per Pound of Plant Food Material†*
	Percent Nitrogen (N)	*Percent Phosphoric Oxide (P_2O_5)*	*Percent Potash (K_2O)*	*Cents*
Inorganic Fertilizers				
Ammonium sulfate	20.0	. . .	. . .	15
Ammonium nitrate	33.5	. . .	. . .	15
Sodium nitrate	16.0	. . .	. . .	20
5-10-5 fertilizer	5	10	5	15
Organic Fertilizers, Fillers, and Soil Conditioners				
Cottonseed meal	7	2.5	1.5	40
Milorganite (non-digested activated sludge)	6	2	0	50
Cow manure	2	1	1	100
Digested sewage sludge	2	1	1	100‡
Compost from municipal refuse	1	1	1	135‡

*Based on dry weights.
†Based on 100 lb. lots.
‡Assuming $4.00 per 100 lb. of commercial product.

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Many basements were saved from being flooded; the threat of a contaminated water supply was reduced to a minimum.

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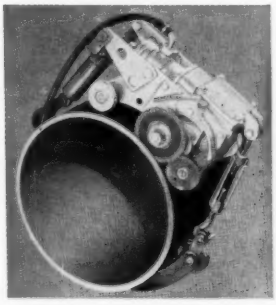

- Weight: only 145 lbs.
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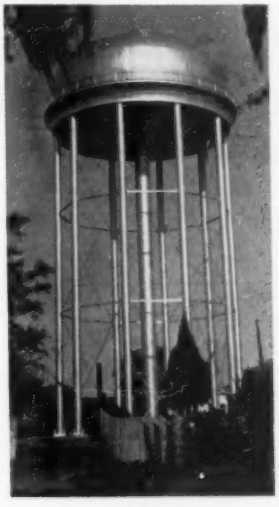

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Mark-Rite Econo-Liner push type shown, available with spray tube or shields, paints lines from 2 to 6 inches wide.

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- See that you get an automatic type gun (we use the best that is made by the largest manufacturer of road striping guns), and don't overlook the strainer.
- Size up your work load, we have the greatest selection, from small push types to large self-propelled sizes of road marking equipment, and can steer you rite.
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- It all adds up to a greater economy in your entire road marking program. There are over 19,000 satisfied users to confirm it.
- Get in touch with your local supply house or write to the factory and ask for a demonstration.

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the price potential of compost. The sludges, sold by three of the largest producers in the United States, are heat-dried activated sludge; all have been on the market for many years.

Chicago and Houston sell their sludge in bulk to fertilizer manufacturers to be used as an organic filler. Although there appears to be a ready market for these products, the revenue they bring the cities is less than $20.00 per ton. (4) Milwaukee markets a sludge product nationally advertised under the name of "Milorganite." The city maintains its own sales organization, selling the sludge in bags to jobbers for the home-gardener trade. In spite of the fact that "Milorganite" retails for $4.25 per 100 lb. bag, Milwaukee realizes only $32.00 per ton for the product. (5) Jobbers' and retailers' commissions plus freight account for more than 50 per cent of the retail price.

It would appear, therefore, that compost in competition with products which have equal soil conditioning values and are somewhat better as fertilizers could be expected to bring a maximum of $20.00 per ton when sold in bulk to fertilizer manufacturers and no more than $30.00 per ton when marketed through an elaborate sales organization to home-gardeners in 100-lb. bags. The possibility of developing a strong market among local farmers is ruled out when one considers the fact that the annual sale of sewage sludges in the whole country is only slightly more than 100,000 tons, almost half of which is sold in California. (6)

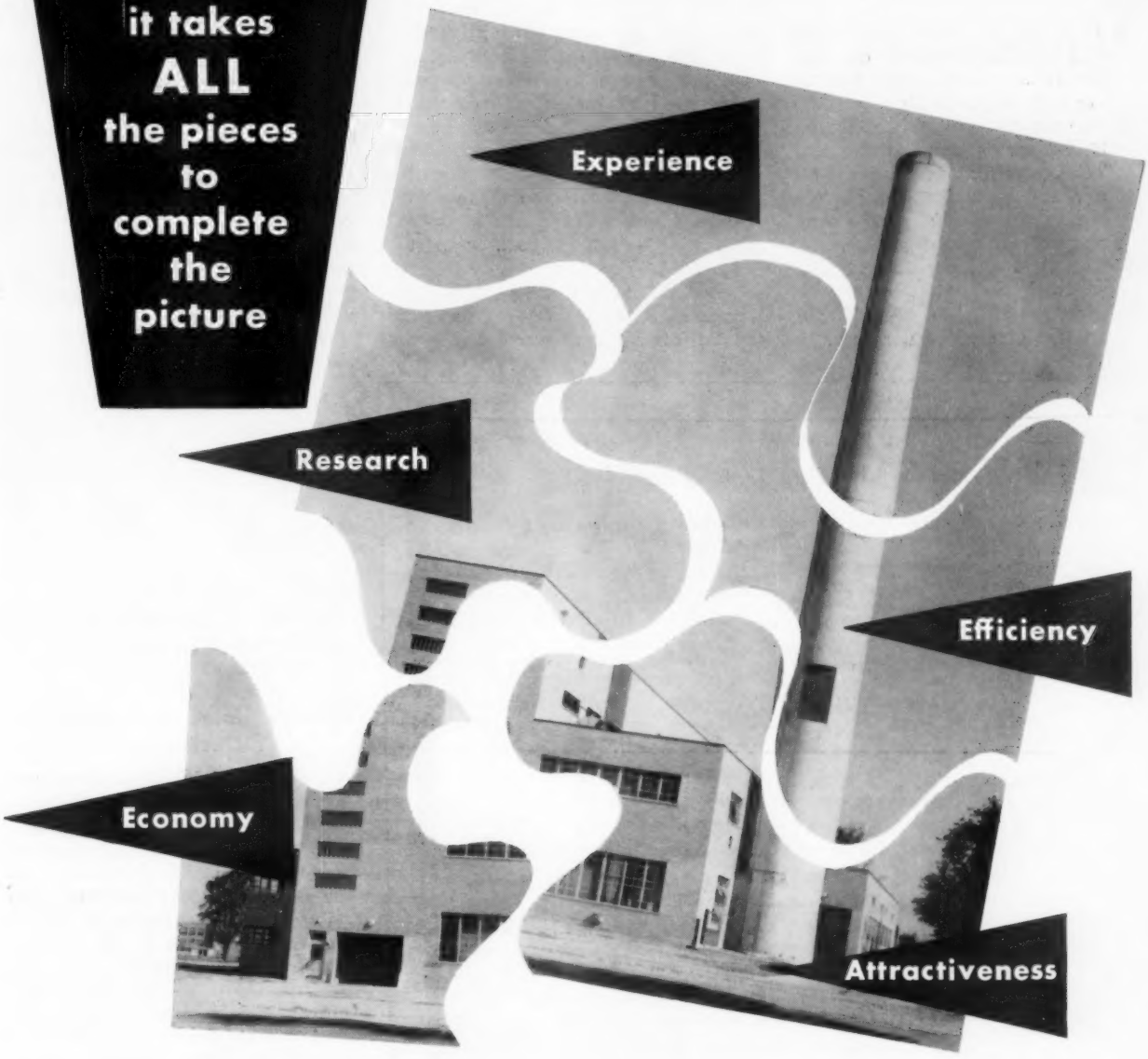
Cost of Production

A number of composting operations have been initiated but most have been of pilot plant scale. Through necessity, therefore, an estimate of compost production cost must be based on information gathered from a limited number of sources.

The Oakland, California, plant of the American Compost Corporation produced compost in open-air piles from 1950 to 1952 for $35 per ton. (7) Municipal refuse was delivered to the plant site by the city free of charge. Tentative plans for future operation of the plant are based on reducing the cost to $21 per ton. (8)

Researchers at the University of California, after making a careful analysis of composting processes currently being advocated in the United States, reported in 1953 (1) that compost might eventually be

it takes
ALL
the pieces
to
complete
the
picture



You can't have a whole without all of its parts; nor can you have a truly modern refuse incinerator plant without the experience and research so necessary to the achievement of an economical, efficient and attractive layout that is a credit to the community. See Nichols for the complete picture.

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produced in open-air piles and sold at a modest profit at about $15 per ton of finished compost provided that:

1. The cost of collecting refuse and hauling it to the disposal site is not considered a part of the cost of production.
2. The profits from salvage accrue to the composting operations.
3. The composting operation is on a scale beyond the economic breakpoint (probably 100 tons of raw material per day).
4. The yield of compost on a dry weight basis is at least 70 to 80 percent of the compostable fraction of municipal refuse.
5. Large scale agriculture will accept the product at such a price.

In a recent article (9), these researchers are more optimistic over the future of open-air composting. On the basis of equipment designs completed by competent consulting engineers during the past two years, the researchers believe that the cost of composting will be less than estimated in the 1953 report. In some places where salvage can be made to pay a share of the cost, composting can be done as cheaply as incineration. Selling prices of five or six dollars a ton—about the price of stable or steer manure—are now being anticipated by some private concerns seriously considering going into the business of commercial composting using designs already completed.

Information concerning the cost of producing compost in digesters is even more fragmentary. Growth, Incorporated, in a proposal made for Kansas City, Missouri, to induce that city to consider composting of its municipal refuse, estimated the cost of compost produced in a digester to be about $12 per ton. (10) Snell, of Michigan State College, predicts the cost of digester compost will be $10. (11)

It must be emphasized that, with the exception of the production cost of Oakland compost, the above figures are no more than estimates. Furthermore, the $35 per ton cost at Oakland might be somewhat misleading. The equipment for preparing the refuse for composting was acquired from a salvage company which had operated previously at the composting site. (2) It is reasonable to assume that capital invested in second-hand equipment would be less than that required for new equipment.

Current Status of Composting Operations

Compost Corporation of American Operation at Oakland, California. The Oakland plant was the first large scale, commercial, open-air operation in the U. S. Started in 1950, operations were suspended in 1952, pending a redesign of buildings and machinery. To date, composting has not been resumed. (10)

Frazer Operation at Mt. Wolf, Pennsylvania. Process and mechanical difficulties forced the abandonment of this digester-type of plant. (12)

Frazer Operation at Bayshore, Long Island. Operations in digester were unsuccessful. Instead of 10 tons per day as predicted, compost production averaged only 3 to 3½ tons per week. Faulty design of the digester plus mechanical difficulties were blamed. (10)

Frazer Operation at Chicago Stockyards. Early operations of composting manure in a digester were abandoned and replaced by a combination open-air and digester process. (12)

Organiculture, Inc., Operation at Miami, Florida. This digester-type plant has been in operation for about a year and is still in the experimental and promotional stage. Only a small percentage of tree and brush trimmings collected by the

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✓ C - Lower Cost with experienced crews and specialized equipment that can restore pipe to a guaranteed 90% of new pipe efficiency. That's the Flexible way!

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city are utilized by the corporation. No garbage is used.

Composting Operations of Growth, Inc., N. Y., N. Y. A pilot plant of the digester-type located on Staten Island has been reported a success. Backed by experience obtained from this operation, Growth, Inc., a non-profit organization, intends to enter into contract with municipal officials to build municipal composting plants, using bond issues to gain the initial capital. All profits are to go into an educational fund. (10)

Ventures Being Considered

Kansas City, Missouri. A proposal was made by Growth, Inc., to build a digester-type of composting plant for Kansas City. The plant was to cost $200,000 and handle 150 tons of garbage daily. (10) Recent information, however, indicates that Kansas City is continuing hog feeding as a disposal method. (13)

Hagerstown, Maryland. Early in 1952 officials of Hagerstown signed a contract with the Frazer interest for the construction of a composting plant like the one at Bayshore, Long Island. In April, 1953, they decided to cancel the contract after hearing about the Bayshore plant's difficulties. Certain parties in Hagerstown are still interested in the possibility of composting the city's refuse. (14)

Milwaukee, Wisconsin. In 1952 Milwaukee investigated the possibility of composting municipal refuse in open-air piles. It was estimated that a plant handling 100 tons of refuse per day would cost about $250,000. After careful consideration, the city decided that composting was not economically feasible. (7)

As mentioned earlier in the report, Milwaukee is one of the largest producers of activated sludge for fertilizer. It is interesting to note that the city is not too satisfied with current operations. A member of Milwaukee's Sewerage Commission recently made the statement that if Milwaukee had it to do over again, it probably would not choose to get in the fertilizer business. He said the city had invested some $7,000,000 in its fertilizer plants and turns out from 185 to 200 tons per day. But whereas it made a profit on early operations, last year it realized only $31.89 a ton from fertilizer which cost $38.69 to make. (5)

Composting has developed as an art rather than as a science, and consequently, like most ancient arts,

(*Please turn to page* 132)

Landfill on 5 garbage dumps handled by 1 D Tournapull

Rig covers garbage delivered by 200 trucks

Modernizing their landfill method of garbage disposal, the City of Dallas, Texas, cut costs by replacing a dragline and 3 dump trucks with a D Tournapull.

Moves 65 yds. hourly on 2400′ cycle

Used to handle fill operations on 5 widely-scattered dumps, the "D" covers refuse delivered daily by 200 trucks. At the city's Irving Street dump, for example, it hauls covering fill from an abandoned levee. Pusher-loaded here with 5 to 5½ cu. yds. of sandy clay in 45 seconds, the "D" completes a 2400′ cycle in about 4 minutes . . . averages better than 12 trips per 50-minute hour.

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When its work at Irving Street is done, the rubber-tired Tournapull drives at speeds up to 28 mph over busy highways to another of the 5 dumps . . . minutes after leaving Irving Street is spreading fill at the new location. This fast, nonstop service gives Dallas prompt coverage, better sanitation, eliminates odors plus fly and rat breeding opportunities. It also makes it possible to plan separated landfill areas for short-haul garbage disposal.

"The D Tournapull has proven entirely satisfactory," declares J. B. Honeycutt, Assistant Superintendent, Sanitation Division, Public Works Dept. "When given help in loading, it handles as much dirt as would a dozen dump trucks."

Saves a day on moves between dumps

Operator C. B. Wilson says: "Now we can keep up with the job without being rushed. Moving the dragline to another dump used to take just about a whole day, but with our new Tournapull it takes only a few minutes."

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3 STEP DISPOSAL

1 Packs in 5½ yds. of cover material.

2 Hauls 2400′ in 3.2 minutes.

3 Dumps load in 10 sec. over 120′ of refuse.

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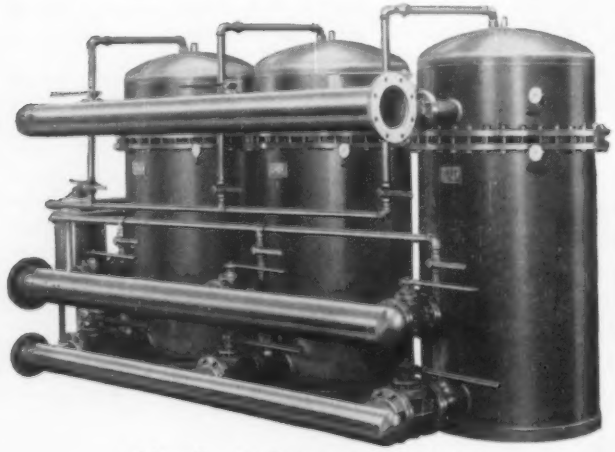

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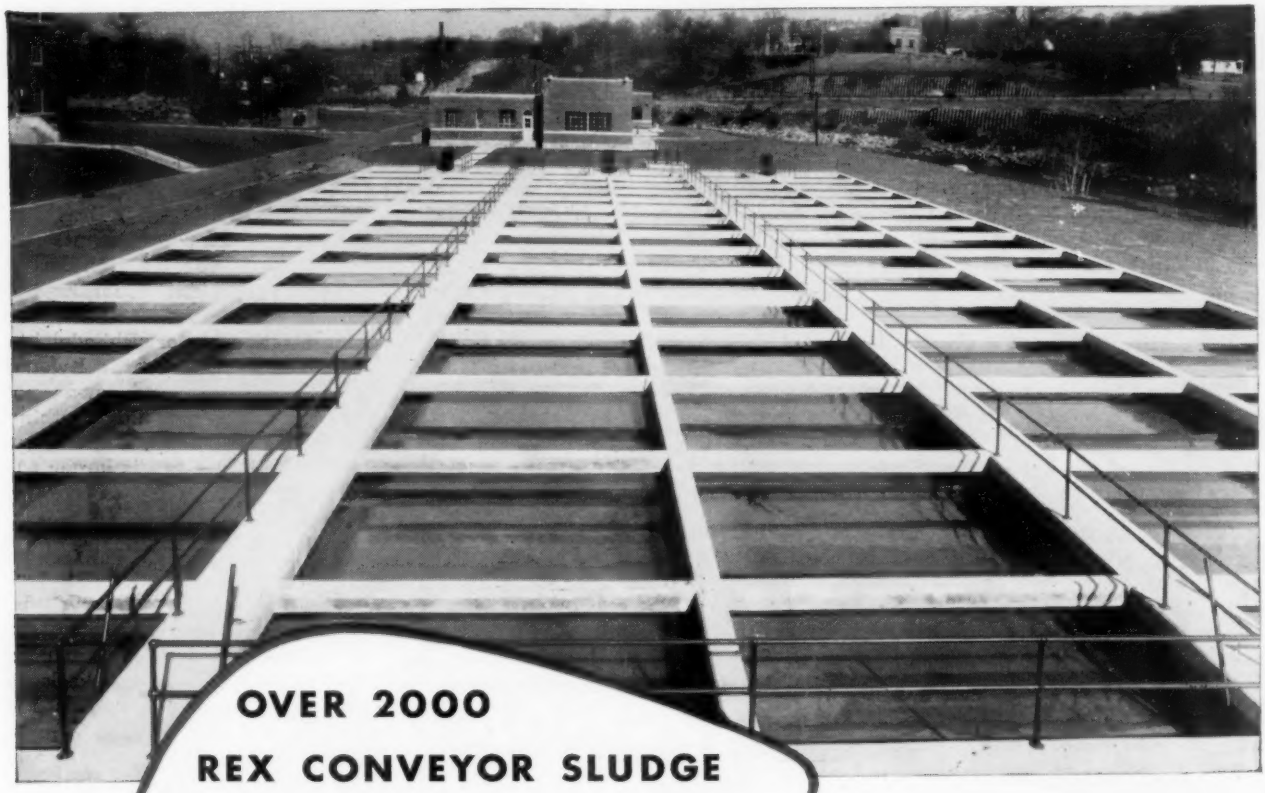

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(*Continued from page* 129)
is surrounded by a haze of misconceptions concerning its fundamentals. Recently, research at two large universities contributed much toward dispelling the haze.

University of California Research (15). The Sanitary Engineering Research Laboratories at Richmond, California spent two years investigating the practice and fundamentals of open-air composting. Results of these studies show that: a) for open-air composting in climates similar to that of the San Francisco Bay Area, compost can be produced from municipal refuse in 12 to 21 days; b) the addition of special innocula of bacteria or enzymes is unnecessary; and c) the greatest technical problem currently associated with open-air composting is that of designing equipment suitable for grinding the mixed refuse and turning the composting pile.

Michigan State College Research. The Department of Civil and Sanitary Engineering has had a high-rate composting digester in operation for over a year. It is reported that garbage is converted by a continuous flow process into a stable compost in 2 to 3 days. Seeding is accomplished by recycling a portion of the end product. (11) From a description of the process, it appears that raw garbage rather than refuse is employed as the raw material.

In a recent letter, (16) Dr. Snell, the head of the department, advises: "In all probability, a larger demonstration plant according to our design will be constructed in either New York or Philadelphia within the next six months. I would suggest that cities and towns not be encouraged to build anything until there has been at least a few months operation in this larger 50-ton plant."

Conclusion

Municipalities currently interested in composting should be aware of the following facts:

1. Compost has been produced from municipal refuse on a large scale by an open-air process requiring 2 to 3 weeks.
2. Continuous open-air composting has been demonstrated as possible only in the San Francisco Bay Area.
3. Except for pilot plants located at Staten Island and the Michigan State College, no digester-type composting plant has been proven to be an operational success.
4. To date, no commercial composting operation has been a financial success.
5. Compost has not yet been marketed in quantities sufficient to effect a stable price.
6. Inasmuch as the total annual sales of sewage sludges (a material against which compost would be expected to compete) in the entire country is only slightly more than 100,000 tons, it is doubtful that local markets could absorb all the compost produced from municipal operations.
7. When sold in bulk to fertilizer manufacturers to be used as an organic filler, compost could not be expected to sell for more than $20.00 per ton.
8. If the compost is bagged in small lots for the highly competitive specialty market, a revenue of no more than $30.00 per ton could be anticipated.

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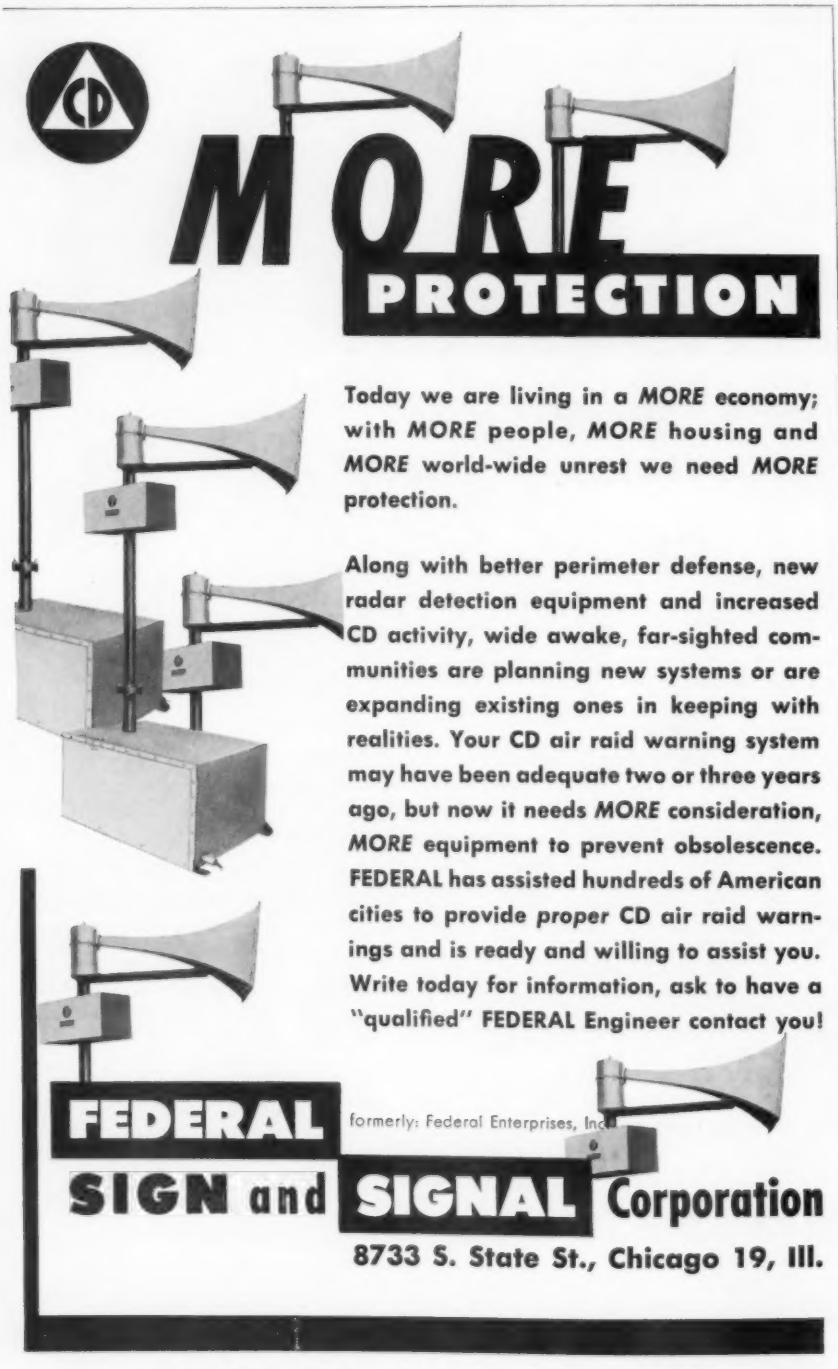
1. "Stabilization of Municipal Refuse by Composting", P. H. McGauhey and H. B. Gotaas, **Proc. ASCE**, October 1953.
2. "Composting for Profit", **Engr. News Record**, June 26, 1952.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3. Advertisements, Frazer Products, Inc., 745-5th Ave., New York 22, N. Y.
4. "Fertilizer Materials Market", **Farm Chemicals**, Jan., 1955.
5. "City Fertilizer Plants 'Risky Business'", **Farm Chemicals**, Jan., 1955.
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11. "High-Rate Composting", J. R. Snell, **Consulting Engineer**, August 1954.
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14. Personal communication, C. D. Williams, City Engineer, Hagerstown, Md. February 1955.
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16. Personal communication, J. R. Snell, Mich. State College, January 1955.

• • •

Maintaining Unpaved Roads with Calcium Chloride

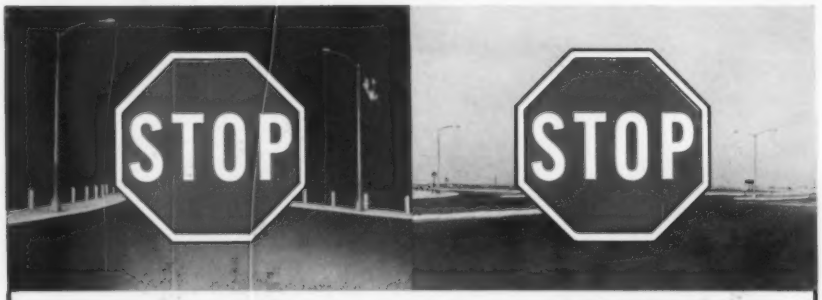
WM. H. BEHRENS,
County Engineer for Linn County, Cedar Rapids, Iowa

A new type of calcium chloride became available a few years ago. This is in the form of pellets and is nearly anhydrous, containing less than one percent of water. In addition to the fact that freight savings are nearly twenty percent, the new material can be shipped in bulk, thereby eliminating the cost of bags. The new material lends itself to mechanical handling and greatly improved methods of application.

During the summers of 1952 and 1953 we experienced extended periods of drought. Under this condition it was difficult to apply the maintenance applications of calcium chloride to the roads at a time when that material was needed most. We needed a method of applying the calcium chloride rapidly, one which would permit the material to penetrate the surface and be sealed in where its moisture would be subject to minimum evaporation.

In 1953 a method of application which seemed to meet these requirements was demonstrated in Linn County. Shipment of 32 tons of bulk pellet calcium chloride was made in a covered hopper car. The road chosen for treatment, a by-pass around Cedar Rapids carrying eight hundred vehicles a day, was kept open during the entire operation. Five hundred tons per mile of stone was spread on the surface just prior to treatment.

The calcium chloride was conveyed from the hopper car by means of a spiral screw conveyor into a truck mounted tank containing a calculated amount of water. The tank was equipped with a 200 gpm recirculating pump and an 8-foot spray bar. As the material entered the water it was immediately dissolved by the action of the pump. Due to the high calcium chloride concentration of this material, considerable heat is liberated, thus accelerating the dissolving action. The quantities of water and calcium chloride were calculated to



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All tailgate mechanism serviced from sides	X	–	–	–	X
Finger-tip operation	X	–	–	–	–
Fully automatic safety door	X	–	X	–	–
Horizontal bulldozer packing	X	–	–	–	–
100% clearing of material jams on the job	X	–	–	–	–
Body floor free of ramps and wheel housings	X	–	–	–	X
Tapered body	X	X	X	X	–
Batch-type loading	X	X	X	–	X
Shortest body length	X	–	–	–	–
No retainer plate	X	–	X	X	–
One underbody hoist	X	X	–	–	–
Tailgate free of hydraulic hoses, pipes and valves	X	–	–	–	–
Hydraulic hoses, pipes and cylinders protected from ash fires	X	–	–	X	X
Total "Plus Features"	14	3	4	3	4

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produce a solution containing four pounds of calcium chloride per gallon. The truck speed and spray-bar were calibrated to deliver 0.12 gal. of solution per square yard to the road. This amount is equivalent to one-half pound calcium chloride and is not sufficient to permit any run-off of the liquid. This solution reaches a temperature of nearly 200° F which reduces its viscosity allowing it to penetrate the road surface immediately. Two passes of the truck were made over the road resulting in a total application of one pound per square yard.

The results of this treatment were immediate and indicated that converting the calcium chloride to a liquid before applying it to the road surface was a valuable step forward in the maintenance of the calcium chloride road.

This type of operation lends itself to the contract system. Last summer we contracted the application of the bulk of our work. We found it highly satisfactory. Evidently the contractor finds it agreeable also because more of them are outfitting to render this service.

These improved methods seem to offer a promising future in the maintenance of unpaved roads. On that segment where pavement is imminent, it provides for the establishment of a tried and proven base for pavements by stage construction. On that segment upon which pavement is not anticipated it provides for the better riding surfaces being demanded, without making additional inroads in the budget and with a possibility of even hastening by savings the advent of much needed pavement on the first segment.

This is a portion of a paper presented by Mr. Behrens at the 1955 meeting of the American Road Builders' Association.

• • •

Minnesota's Highway Equipment

The Minnesota Highway Department's equipment inventory consists of 5,619 pieces, including 1,883 major units such as cars, trucks, motor graders, shovels, bituminous distributors, rotary snowplows, etc., and 3,636 pieces of smaller or miscellaneous units such as tar kettles, snowplows, mowers, sanders, etc.

Fellowships in Sanitation

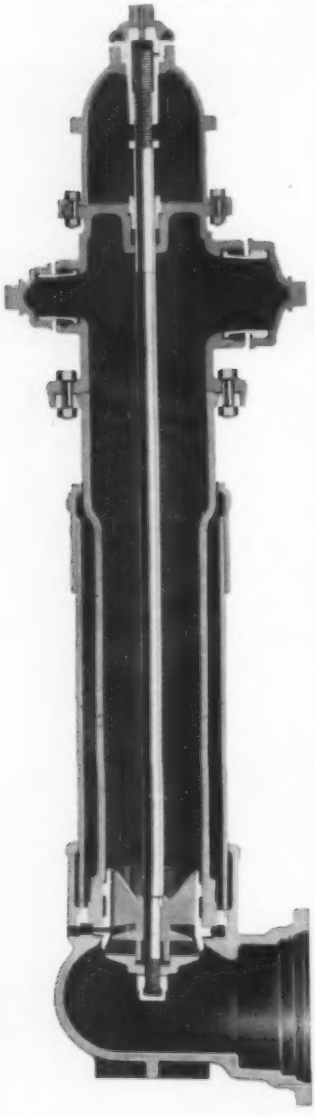
Research Fellowships in Sanitation, for 1955, are available from Rutgers University. They are open to residents of the United States and Canada. Applications and additional information may be obtained from: Dr. Harold E. Orford, Chairman, Department of Sanitation, The Tower Bldg., Cor. Jones & Sandford Sts., Rutgers University, New Brunswick, N. J.

New Partners for Consulting Firm

Seelye, Stevenson, Value & Knecht, Consulting Engineers of New York City, announce the following new partners to their firm as of January 1: Gilbert D. Fish, C. E.; A. Roger Kelly, E. E.; Erik B. J. Roos, M. E.; Stephen D. Teetor, C. E.; and Harold S. Woodward, M.C.E. The firm will continue its practice under its present name.

New Executive Assistant

E. Arthur Bell of Essex Fells, N. J., has been appointed Executive Assistant to the President and Chief Engineer of the Stamford, Conn., Water Company. He was formerly Water Superintendent of Essex Fells since 1937, which position included the engineering and managing of the water system supplying Verona, Caldwell, North Caldwell, West Caldwell, Roseland and Essex Fells, N. J.



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BOOKS IN BRIEF

PRESTRESSED CONCRETE

This is the third edition of a book by Gustave Magnel, University of Ghent, Belgium. Statically determinate beams are discussed fully in Chapter 3, following information on the principles of prestressed concrete and methods of prestressing. Chapter 4 covers continuous structures. Creep of steel and concrete, buckling of members and effect of time and load on prestress are covered in other chapters. Translation is by Charles C. Zollman who also converted metric dimensions to our equivalents. 343 pages, 328 illustrations. McGraw-Hill Book Co., 330 West 42nd St., New York 36, N. Y. $8.

BIONOMICS OF MOSQUITOES

This is a tremendously complete and useful book — perhaps not so much for the engineer as for the entomologist and scientist. It does not tell much about engineering methods of control, which is one thing the engineer is interested in but it does describe all kinds of mosquitoes and gives detailed information on their habits and habitats. Thus, there is a great deal of background information that the engineer must have if he is to plan his control measures properly. Arrangement of material is by accepted taxinomic classifications. A complete summary of research to date is given and a 75-page bibliography. The author, Dr. W. R. Horsfall, who was one of the Sanitary Corps entomologists in the Southwest Pacific, is now Associate Professor of Entomology at the University of Illinois. The book is published by Ronald Press, 15 East 20th St., New York 10, N. Y. There are 723 well-filled pages; the price is $16.

PRESSURE-TREATED DOUGLAS FIR

This is an 11-page reprint covering three types of treatment—creosote, pentachlorophenol, and wolman salts. Among the uses for this product are: bridges and trestles; foundation piling; highway culverts; highway posts; retaining walls; fence posts; hangars; walkways. Copies free by writing to Paul D. Christerson, Dist. Manager, Wood Preserving Dept., Pope & Talbot, Inc., 3070 N. W. Front Ave., Portland 10, Oregon.

WROUGHT IRON FOR HIGHWAY CONSTRUCTION

This booklet contains a discussion of how wrought iron resists corrosion and fatigue; also a review of several highway installations in which wrought iron has been used, with illustrations. Copies free from the Advertising Dept., A. M. Byers Co., Pittsburgh, Pa.

MONTEVIDEO MUNICIPAL REPORT FOR 1953

The 1953 report of the City of Montevideo, Uruguay, is one that many cities could copy with profit. The population is now nearly one million. The report tells of the work that is being done to maintain suitable municipal facilities for these people. Illustrations and charts are excellent and are printed in colors to make them most effective. The text is in Spanish. The report, sent us by the Departmento de Obras Publicas, Montevideo, contains 288 pages.

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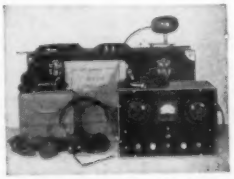

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PUBLIC WORKS DIGESTS

The INDUSTRIAL WASTE Digest

In-Plant Control Of Dairy Wastes

The Dairy Industry Committee has published a manual for plant operators entitled "Waste Prevention in the Dairy Industry," in which it classifies the sources of waste under six heads: leakage, overflow, spillage, freezing on cans, willful waste, and carryover. The author of this paper, sanitary engineer of the Dairymen's League Cooperative Ass'n, gives illustrations of each of these and methods of preventing them; also shows that in many cases a direct monetary saving can be made by eliminating them; but the general reason common to all waste reduction is prevention of stream pollution, or lessening the load on the treatment plant where the wastes are treated for this purpose. In seven plants where drip savers were used, the milk collected in them averaged 24.5 lb. per 10,000 lb. dumped. Improvements in milk handling equipment other than drip savers on the can washer have reduced materially the loss of milk to the sewer. These include whey savers; automatic bottle casing equipment, and many others. The Hershey Chocolate Co. processes about 1,000,000 lb. of milk per day, and the installation of entrainment separators saved 3,000 lb. of milk and 1,000 lb. of sugar per day in producing sweetened condensed milk, a saving of $205 a day.

"In - Plant Control of Dairy Wastes." By Clifford Watson, Jr. *Sewage and Industrial Wastes,* January.

Oxidaton of Phenolic Wastes

As a result of studies made by the Dow Chemical Co., it was learned that biological oxidation as a treatment method for phenolic wastes is feasible, and can be operated without sanitary sewage for seed. The author gives lists of the organisms found in the pilot plant, nearly 40 percent of which attack phenol; 55 percent of those in the aeration tanks have soil as their natural habitat, and about 20 percent have water.

"Bacterial Studies in Oxidation of Phenolic Wastes." By G. E. Lynn and T. J. Powers, Dow Chemical Co. *Sewage and Industrial Wastes,* January.

Industrial Wastes In Public Sewers

Municipalities should cooperate with industries and all wastes that can be accepted into a sewer system and sewage plant should be taken in if, and only if, the plant is of sufficient capacity and can successfully treat the waste. This paper outlines factors that should be taken into consideration in deciding on the acceptability of a given waste, and suggests methods of admittance and regulation. Thirty different process wastes are considered, their general characteristics, and the sewage treatment units or processes which may be adversely affected by each.

"Acceptability of Industrial Wastes in Public Sewers". By Alfred A. Estrada; George A. Elias, Penn. Dept. of Health; and Gordon J. Wiest, Warner Co. *Sewage and Industrial Wastes,* January.

Regulating the Admission Of Industrial Wastes to Sewers

Reasons in favor of including all wastes that can possibly be received in public sewers are: 1—It is more economical and feasible to treat a combination of wastes and domestic sewage than to treat each separately. 2—Better supervision and control is possible. 3—It relieves the industry of the responsibility of treating its wastes, which it often is not qualified to do. But admission of wastes should be denied under certain conditions, and should be regulated if permitted. No general regulations applicable to all cases are possible, but the authors list certain minimal restrictions and guiding principles that all systems should include. All restrictions and safeguards should be on the basis of actual or potential danger to human life and comfort, to sewer and sewage plant structures, and to the operation of the treatment plant.

"Industrial Wastes in Municipal Sewers—Flexible or Strict Regulations". By H. Heukelekian and H. E. Orford, Rutgers Univ. *Sewage and Industrial Wastes,* January.

Use of Reclaimed Sewage at Amarillo

In 1951, Amarillo, Texas voted bonds for improving its sewage treatment plant, intending to provide only primary clarification and sludge digestion, to which a high-rate filter plant could be added when necessary. The Texas Co. was preparing to enlarge its plant and proposed to the city that it purchase reclaimed sewage water for use in the plant, believing that it could be used for at least some refinery purposes, that the cost would probably be comparable to that of fresh water, that the supply would be absolutely dependable, and the project would be a water conservation measure. A contract was made under which the city is to furnish 1.5 to 4.5 mgd, with lagoon storage of a 3-day supply; the water to have a pH of 6.8 to 9.0; suspended solids of 25 ppm maximum; 25 ppm maximum BOD, and 0.1 ppm chlorine residual. An activated sludge plant is to be constructed. If the company uses only 1.5 mgd, the cost to it will be 13.32 cts per 1,000 gal. as compared to 13.67 cts for city water; reduced to 6.94 cts if it uses 4.5 mgd.

"Industrial Use of Reclaimed Sewage Water at Amarillo". By Marvin C. Nichols. *Journal Am. WW Ass'n.,* January.

Other Articles

"Evaluation of Toxicity" in connection with stream sanitation. **By Robert S. Ingols. Georgia Inst. of Technology. Sewage and Industrial Wastes, January.**

"Effect of Toxic Metal Ions on Oxidation". By H. Heukelekian and I. Gellman. Rutgers Univ. Sewage and Industrial Wastes, January.

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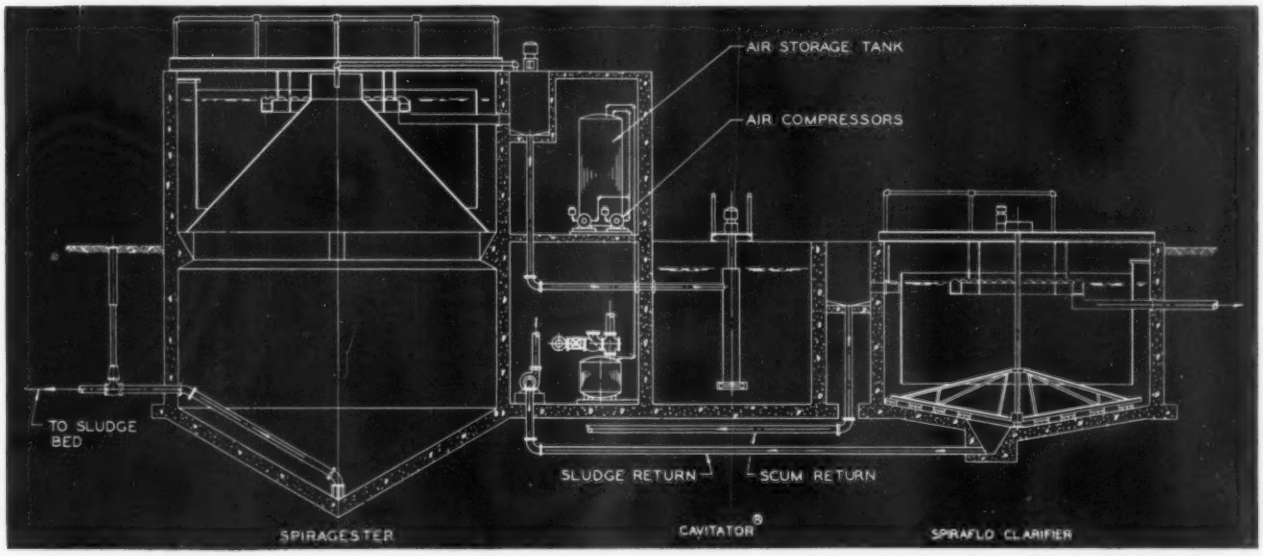
For Municipal Waste Treatment



One of the many possible arrangements is illustrated. The secondary treatment is provided by the Cavitator mechanism, a specially designed rotor with two arms mounted on a hollow shaft through which air is drawn for dispersion through the tank contents. The arms are streamlined with the outer ends so constructed that when they are passed through the liquid at relatively high speeds they create a zone of cavitation through which the liquid is recirculated continuously. Air and liquid are drawn into the cavitation zone under vapor pressure conditions. As the bubbles rise they implode with such tremendous force that the pressure actually drives the oxygen into the tank.

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- **high oxygen transfer efficiency**—requires only 135 cu. ft. of air per lb. B.O.D. removal per day in the Cavitator system.
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BULLETIN S-50

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Water Use in Maufacturing

WATER INTAKE during 1953 by manufacturing establishments using 20 million or more gallons amounted to 11.4 trillion gallons according to the latest Annual Survey of Manufacturers by the Bureau of the Census, Department of Commerce. Over 2 trillion gallons of this water was brackish (salt). About one-half of the total water intake was in establishments which recirculated over 5 percent of their water intake. Approximately 20 percent of the total fresh water intake was in establishments depending primarily on public water systems for their fresh water. About 67 percent of all fresh water was accounted for by establishments depending for such water primarily on company operated surface-water systems. This water was obtained from streams and lakes. The remaining 13 percent came from company operated ground-water systems, fresh water being obtained from wells and deep springs.

In the report, water information for establishments using 20 million gallons or more water is shown for each of the 20 major manufacturing industry groups and for other selected industries. The primary metal industries accounted for over 32 percent of the total water intake. Chemical industries accounted for 24 percent of the total, petroleum and coal products for 17 percent, paper and allied products for nearly 11 percent, and food and textile for about 7 percent.

The total annual water intake for establishments using 20 million or more gallons in all manufacturing industries averaged about 1.5 million gallons per employee engaged in manufacturing. This ratio varied greatly among industries. The highest ratio shown was for blast furnaces, which had a water intake of nearly 24 million gallons per employee. Other high ratios were: about 22 million gallons per employee for electrometallurgical products; 17 million for alkalies and chlorine; 14 million for organic chemicals; 12 million for pulp mills; 11 million for petroleum refining; 9 million for byproduct coke ovens. The lowest ratios were shown for the aircraft industry, amounting to about .03 million gallons per employee, and for the telephone and telegraph equipment industry, amounting to only about .05 million gallons. The water intake per employee ratio was generally higher for large establishments than for smaller ones. On the basis of the ratios for the smaller establishments

it is estimated that those using 20 million gallons or more water account for between 90 and 95 percent of the total.

Data on water use are also shown for 47 of the States in the report. The States that were the largest users of water were: Pennsylvania about 1,397 billion gallons, Ohio 1,268 billion gallons, Texas approximately 1,159 billion gallons and New York 933 billion gallons. The total water intake per employee was highest for Louisiana where the ratio was 8.7 million gallons per employee. Other States which had high ratios were: over 6.7 million gallons per employee for West Virginia, 6.4 million gallons per employee for Texas and 5.1 million gallons per employee for Florida.

These data were prepared by the Bureau of the Census, Industry Division, and were sent us by the Business and Defense Services Administration.

Improvement in Handling of Complaints

Key West, Fla., has a new system of handling complaints and requests for special services, resulting in improved public relations and reductions in the time required to process complaints. This consists of a central complaint desk which receives all complaints, either by telephone, directly from a citizen, or in writing from any city employee. A form is filled out in duplicate, the original sent to the department concerned and the other is filed. When the complaint is corrected or the special service performed, the original form is returned and stapled with the duplicate and filed for six months, after which it is discarded. A postcard with a return postcard addressed to City Manager V. A. Lang is sent to the person requesting the service to find out whether it has been performed satisfactorily. If the complaint is not corrected within a week, the city manager sends a follow-up to the department head to determine the reason for the delay. This method results in prompt handling of service requests and complaints. *Public Management.*

Control of Industrial Stream Pollution

The New Jersey Section of the American Institute of Chemical Engineers will hold a one day symposium at the Hotel Essex, Newark, N. J., on May 10. The entire afternoon session will be devoted to a discussion of Industrial Stream Pollution.

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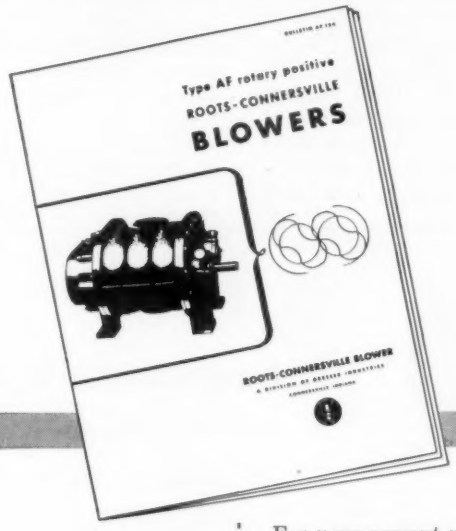

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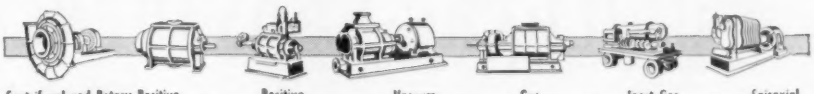

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Second Sanitary Engineering Workshop Finds:

Develop Waste Control Ordinances with Industry-Municipal Teamwork

JOHN BUMSTEAD

INDUSTRIAL, municipal and engineering officials from four states gathered at the University of Cincinnati last January 27th to make the Second Sanitary Engineering Workshop a success. This success stems from the fact that the use of the audience-participation procedure —instead of the delivery of prepared papers—generated considerable interest as well as effective participation.

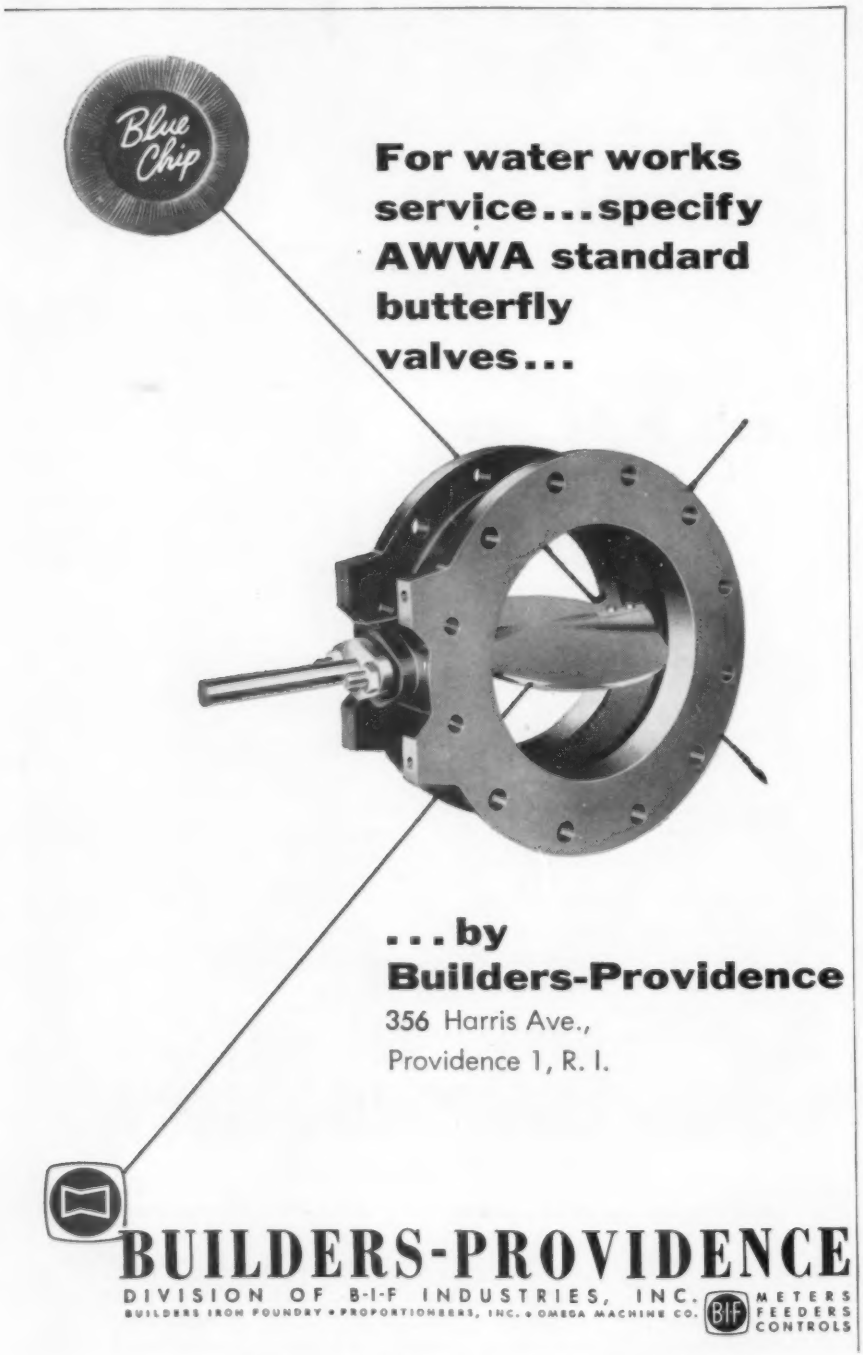
The meeting was sponsored by the Cincinnati Section of the American Society of Civil Engineers and the School of Civil Engineering, University of Cincinnati. It is the forerunner of future meetings wherein timely engineering topics will be subjected to analysis in open discussion by various business and professional interests to find a common ground for the solution of mutual problems in an exchange of thinking.

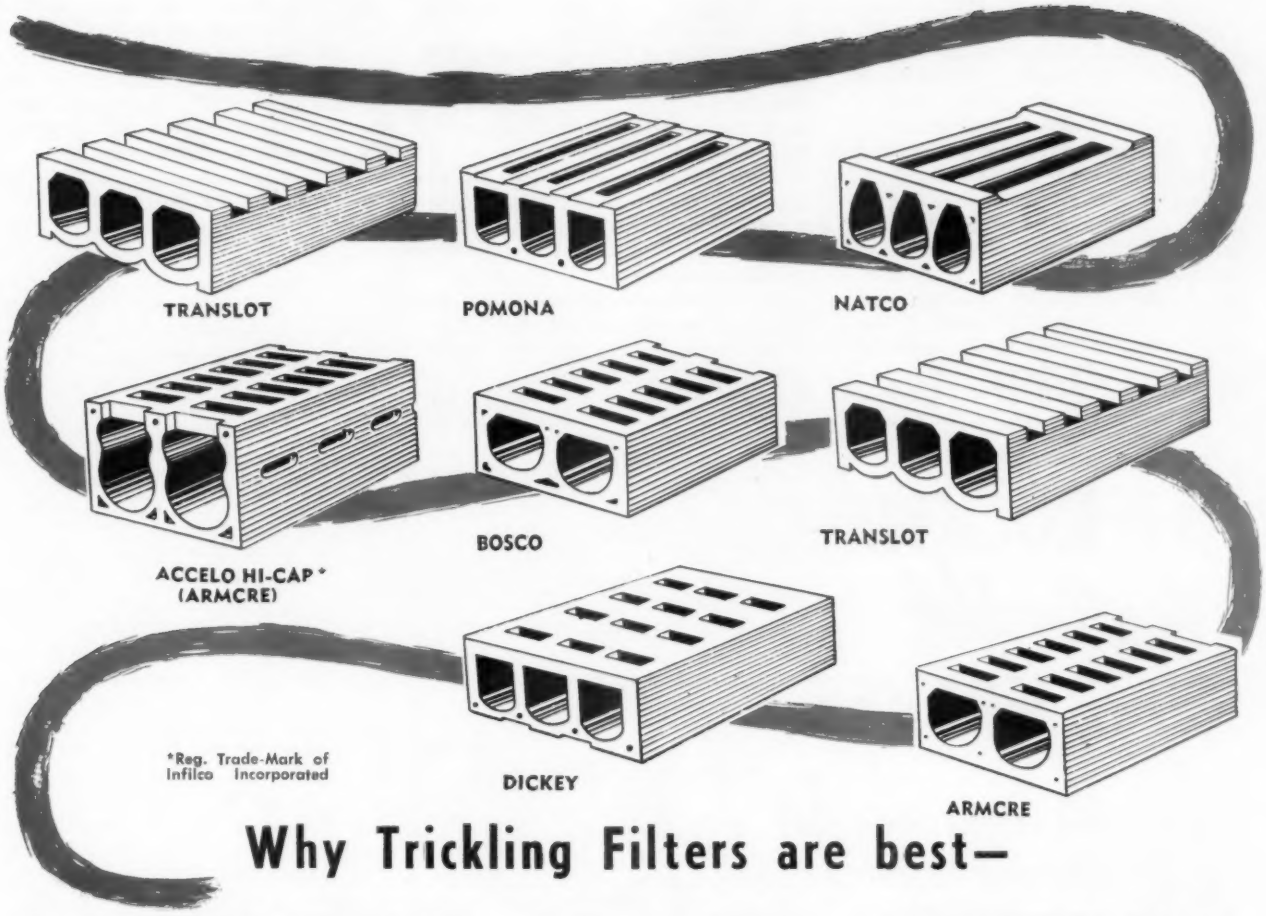
The theme of the discussions revolved around an endeavor to define some of the "ground rules" for the development of industrial waste control ordinances which may be adopted by municipalities with a minimum of friction and a maximum of practical acceptance. One conclusive finding is that it is not possible to generalize on such ordinances or to establish a model which will serve for all communities and situations equally well. In fact, it was agreed that each industrial waste ordinance must be developed on a tailor-cut basis to satisfy local conditions, such as existing and future treatment types and capacities and the unusual or peculiar conditions of industrial processes or location.

It was established that the practice of copying existing ordinances which have been worked out for one community and then attempting to apply them without study or proper application for another community runs the risk of serious error or economic inequity. Local requirements such as the characteristics, strengths and volumes of domestic sewages as well as of industrial wastes must be taken into prior consideration when formulating industrial waste ordinances. Thorough basic engineering investigation and analysis is called for more than ever when an industrial waste control ordinance is being developed; the handbook approach is risky and outmoded in a field such as this with all its unmeasured variables.

When an industrial waste control ordinance is being considered, industry likes to know about it and would like to be taken into the picture early in the game. This view was expressed by Claude Prichard, plant manager, Arvin Industries, Inc., Columbus, Indiana. He stated that an ordinance passed and applied without industry's participation makes it "difficult to swallow." He added that mistakes are often made in basic considerations that could have been avoided if industry had been a part of the team to develop a reasonable ordinance. Other speakers seconded this viewpoint saying that cooperative participation generally made for easier acceptance and less opposition.

John E. Kinney, sanitary engineering consultant, Ann Arbor, Michigan, pointed out that small communities with one or two in-





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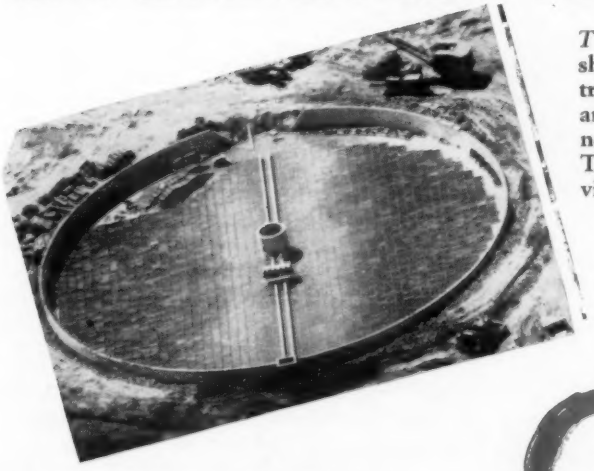

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dustries probably should not attempt to adopt a general ordinance for industrial waste control. Their best procedure, he said, would be to deal individually with each industry and work out mutually satisfactory conditions for contractural handling of industrial wastes. The conditions to be satisfied are innumerable; he listed some: Existing or proposed sewage plant; type of treatment; type, volume and characteristics of the industrial waste; strength and volume of sewage coming to the municipal treatment plant; type of management at sewage plant; intermittent or continuous discharge of industrial wastes; and toxicity of industrial wastes.

Some strong wastes cannot be discharged into municipal sewers and must be pretreated. This statement was made by Erwin A. Emmer, Director of Engineering, Emery Industries Inc., Cincinnati, who added that such 'aggressive' wastes made it mandatory for industry to spend considerable sums of money for pretreatment works.

One essential requirement for an industrial waste control ordinance is an enforcement provision with 'teeth' in it. William E. Ross, superintendent of sewage disposal, Richmond, Indiana, said that without such a provision an ordinance isn't worth the paper it is written on. However, the conditions to be met before the penalty is applied must be reasonable and based on sound engineering investigation.

Effect of State Law

State laws have an important effect on municipal ordinances that deal with industrial wastes. In Indiana for example, Dwight O. Bender, superintendent of the Indianapolis Sanitary District, said that certain wastes are prohibited from public sewers. He favors the exclusion of toxic wastes that may inhibit or destroy bacteriological action or produce noxious gases in the sewers. He believes that industry should handle toxic and high suspended solids wastes before discharge to the sewers.

Cyanide wastes are over-emphasized; or at least they are the cause of widespread fears that may be unjustified. This appeared to be the consensus of experts at the meeting. John E. Kinney reviewed the cyanide-toxicity picture and called attention to the fact that much additional work is needed to pin-point the effects of cyanide wastes in sewage and receiving waters.

In conclusion, Arthur D. Caster, sewage disposal engineer of Cincinnati, Fred C. Olds, plant engineer of Procter & Gamble Co., and Dean Taylor, senior engineer, Cincinnati summarized the discussions. These facts were developed as guideposts for preparing industrial waste control ordinances: Industry can contribute substantially to the preparation of industrial waste control ordinances and its thinking is now geared to the public responsibilities it holds. Fewer mistakes will be made if municipal officials and industrial experts get together and come to a common ground for writing a control ordinance. Industry can have its managerial thinking jarred and the chances are that unexpected benefits will accrue. The conference table approach without the mental harassment of aggressive legal advice where honest men sit down to find honest answers holds the greatest promise of success; and small communities should retain competent consulting engineers to guide and represent them in developing sound contracts with industry which will reflect equitable engineering controls for the discharge of industrial wastes as well as define reasonable standards for payment by industry of the additional cost of handling and treating industrial wastes.

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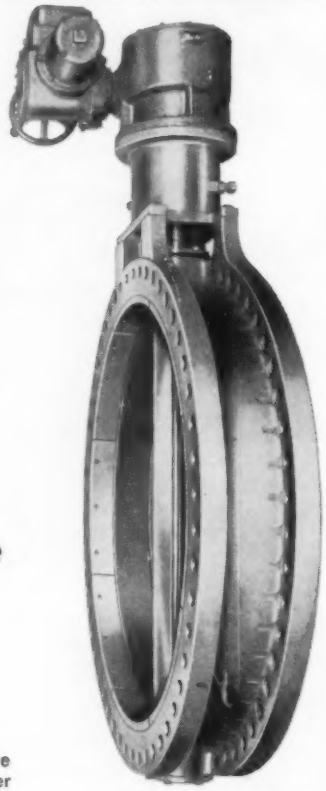

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PUBLIC WORKS DIGESTS

The SEWERAGE AND REFUSE *Digest*

Joint Treatment Plant Not Feasible

Five neighboring towns in Beaver County, Pa., with populations ranging from 2,540 to 27,500, ordered to prepare plans for primary treatment of their sewage, employed an engineering firm to prepare such plans. A joint plant was considered but was not thought to be feasible for several reasons; it would involve a crossing of the Ohio river; pumping the sewage from one or more of the plants; long outfalls to the plant. Moreover no satisfactory agreement between the municipalities could be reached. In most cases the amount of savings made possible by joint projects are insufficient to induce municipalities to give up the control of managing their own projects.

"Five Neighboring Towns Plan Five Primary Sewage Plants". By S. I. Zack and Frank M. Williamson, Consulting engineers. *Wastes Engineering*, February.

Baltimore's New Incinerator

Two of the three incinerators of Baltimore, Md. having been put out of service by obsolescence, the capacity of the third, twenty years old, was increased 33 percent by installing hydraulically operated stokers. A fourth is being constructed, of the pit and crane type, with an overload capacity of 1,000 tons per day. The charging gates are pneumatically operated; charges will be deposited at the rear of the furnace on a sloping grate composed of alternately moving parts—a type used in incinerator No. 3 since April 1953. The ash hoppers are equipped with cast iron sliding gates hydraulically operated. To provide ventilation and lighting of the ash floor, the side opposite the furnaces has a continuous row of rolling doors. Forced-draft fans for the furnaces take suction from the ash floor to remove smoke and water vapor. To facilitate the removal of fly ash and clinker from the expansion chambers and flue spaces, a central vacuum cleaning system is to be installed. Certain materials are now being salvaged from the refuse at plant No. 3, but because of high labor cost, poor housekeeping and lack of markets, no salvage facilities will be installed at the new incinerator.

"Old Plant Guides Design of New Baltimore Incinerator." By Roy H. Ritter and R. C. Regnier. *Civil Engineering*, February.

Trickling Filter With Precast Walls

In constructing the treatment plant at Exton, Pa. of the White Motor Co., an unusual method was used in building the trickling filter. The walls were made of precast concrete segments, each 12 ft. long, 8 ft. high and 8 in. thick. Horizontal reinforcement rods were extended a short distance beyond each end of each segment, and when the segments were in place the ends of the rods of adjacent segments were welded together, and the spaces between segments were then filled with concrete. The segments were cast horizontal and set by crane on a prepared foundation.

"Sewage Treatment for a Manufacturing Plant". By Edwin B. Wagner. PUBLIC WORKS, March

Shoring a Sewer Constructed in a Peat Bog

In constructing a sewer at Vancouver, B .C., the line ran for 3,000 ft. through a peat bog where the peat was 12 ft. deep and the depth of the sewer averaged 16 ft. The sides of the trench had to be braced, and for this purpose the city used a plan of prefabricating timber frames 12 ft. long and placing them alongside the trench, which was excavated with a backhoe. When a sufficient length of trench had been excavated, the backhoe picked up a frame and set it in place, and vertical sheathing was then placed in position in the frame. Thus it was not necessary for any workmen to be in the trench until it had been sheathed. The construction of the frames and details of using them are described by the author, who was responsible for the construction.

"Building a Deep Sewer in a Peat Bog." By G. M. Barclay, Supt. of Sewers. PUBLIC WORKS, March.

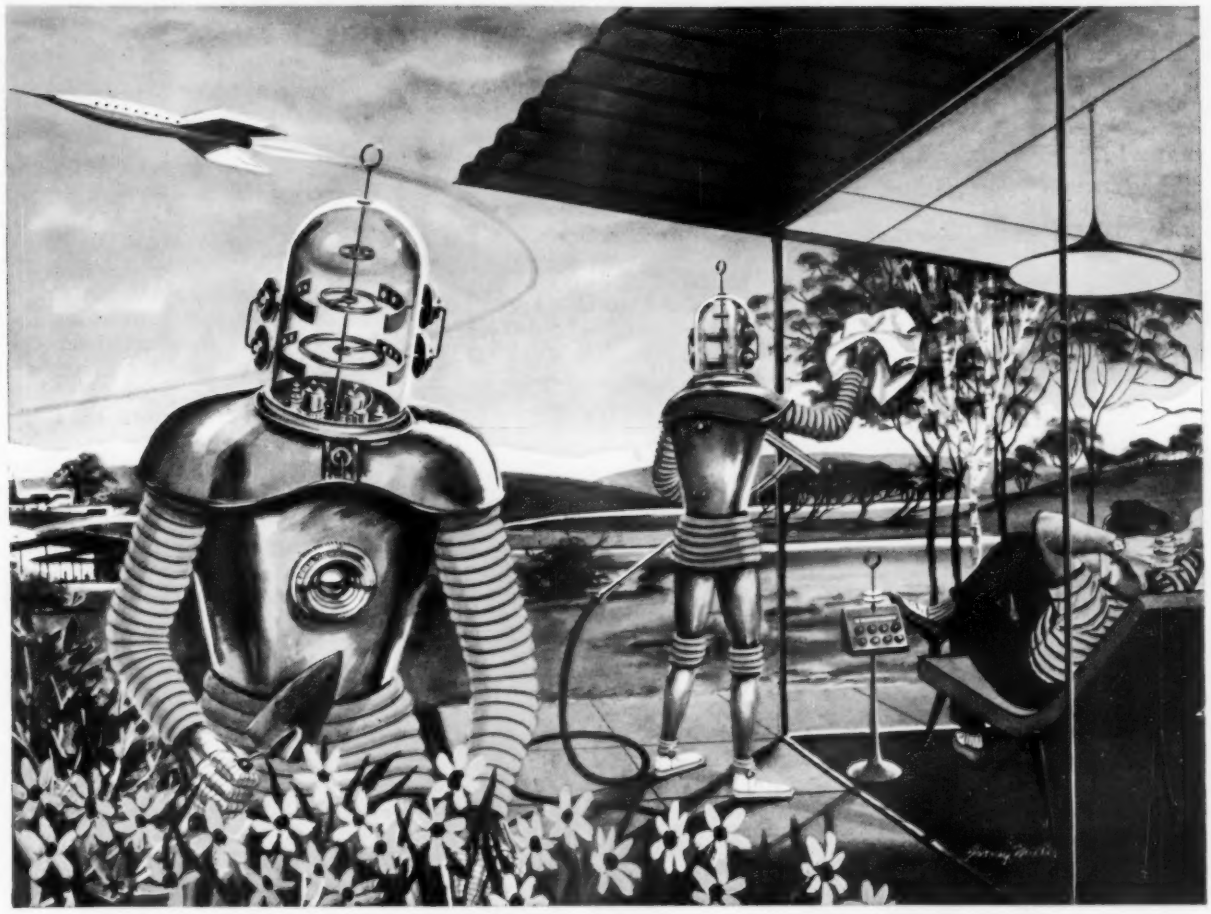
Recent Developments Sewage Disposal

In an annual review of "Techniques and Trends" in the sanitation field, Engineering News-Record describes some developments that show signs of solving at least part of the sewage disposal problem. Among them are the Laboon process; high-rate digestion; regional programs; and long ocean outfalls in place of secondary treatment. In industrial waste disposal a significant development was the use of activated sludge treatment of pulping mill wastes. Research in treatment of radio-active wastes was mentioned; also reclamation of sewage effluents. Brief descriptions are given of more than fifteen large sewerage and sewage disposal projects.

"Techniques and Trends and Major Projects". — *Engineering News-Record*. Ferubary 17.

Determining Dissolved Oxygen With Solid Platinum Electrodes

The determination of dissolved oxygen in heavy sludges by the Winkler test is not satisfactory. The polarographic method using the dropping mercury electrode is an improvement, but this also has objectionable features. Studies on the use of solid platinum electrodes have been made at the University of North Carolina and at Georgia Institute of Technology. The former reports that two factors interfere with the use of rotating platinum electrodes—the need for the addition of salt, and the apparent filming of the electrode. Tests at the latter college indicated that this method has the simplest electrode system and the best reproductibility for the determination of dissolved oxygen in a sample which is comparatively



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free of biological degradation products, and is desirable where the water is free of flocs and highly saline.

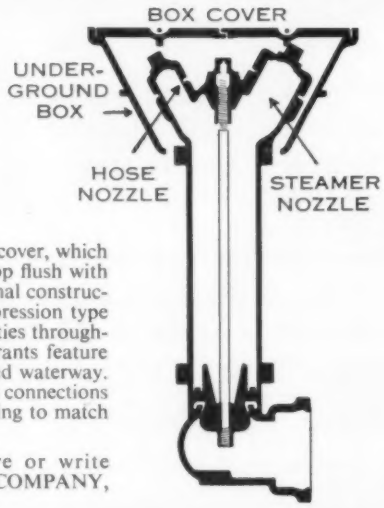
"Experience With Solid Platinum Electrodes in the Determination of Dissolved Oxygen." By Walter R. Lynn and Daniel A. Okun, Univ. of North Carolina; and Robert S. Ingols, Georgia Inst. of Technology. *Sewage and Industrial Wastes*, January.

Effect of Fluorides On Sludge Digestion

Investigation of the effect on sludge digestion of fluorides in the water supply showed that the addition of almost 5 ppm NaF (concentration probably exceeding by at least 10 times the concentration to be expected) did not affect digestion activities in two experiments extending over 75 days. From these results it appears unlikely that the pressure of a normal fluoride concentration would produce detrimental effects on the digestion of sewage solids.

"Effects of Fluoride Concentration on Sludge Digestion." By Werner N. Grune and Robert Q. Sload, Georgia Inst. of Technology. *Sewage and Industrial Wastes*, January.

This M & H Hydrant sets completely underground. The cast iron box cover is on line with the ground level, thus completely eliminating any interference with traffic. M & H flush type hydrants are especially designed for use at airports servicing the heaviest modern airplanes.



The operating nut and nozzles are accessible simply by lifting the two piece cover, which has disappearing handles designed to drop flush with the cover when not in use. Hydrant internal construction is exactly the same as M & H compression type fire hydrants used by so many municipalities throughout the country. M & H flush type hydrants feature a 5¼" valve opening and an unobstructed waterway. Can be supplied with one or two fire hose connections and/or with steamer nozzle, with threading to match existing standards.

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Nitrogen in Sewage Sludges

The fact that a material contains a certain percentage of nitrogen does not indicate whether it would be of value as a fertilizer. Much depends on whether the nitrogen is in a form which would be converted to ammonia or nitrate in the soil and so made available to plants. Laboratory soil tests made in England with sewage sludges and dried blood have shown that nitrate is formed more readily from activated sludge than from other sludges, comparing well with dried blood, and can therefore be regarded as a high-grade fertilizer. Raw primary sludge was usually formed to take up nitrate from the various spoils employed in the test for at least 21 days.

"Availability of Nitrogen in Sewage Sludges". By R. J. Stephenson, Public Health Dept., London. *Sewage and Industrial Wastes*, January.

Cavitation Treatment At New Holstein, Wisc.

In 1954, New Holstein began treating its sewage and canning wastes in a plant containing an aerating device thus used for the first time, called a cavitator. This is believed to create and utilize pressure differentials in the sewage so that the oxygen introduced can be utilized with the highest efficiency and at the greatest speed practicable; utilizing 25 percent of the available oxygen as compared with 5 percent by conventional aeration. The aerator contains a vertical draft tube at the bottom of which is a rotor which is revolved at a speed which creates underpressure in the tube, down which the sewage is drawn. The plant is capable of providing over 90 percent BOD removal with an air supply of only 110 cu. ft. per pound of BOD per day.

"New Low-Cost Treatment System Introduced at New Holstein, Wisc." By Karl L. Schulze, Int. Agricultural Products, and Herbert S. Foth. *Water & Sewage Works*, February.

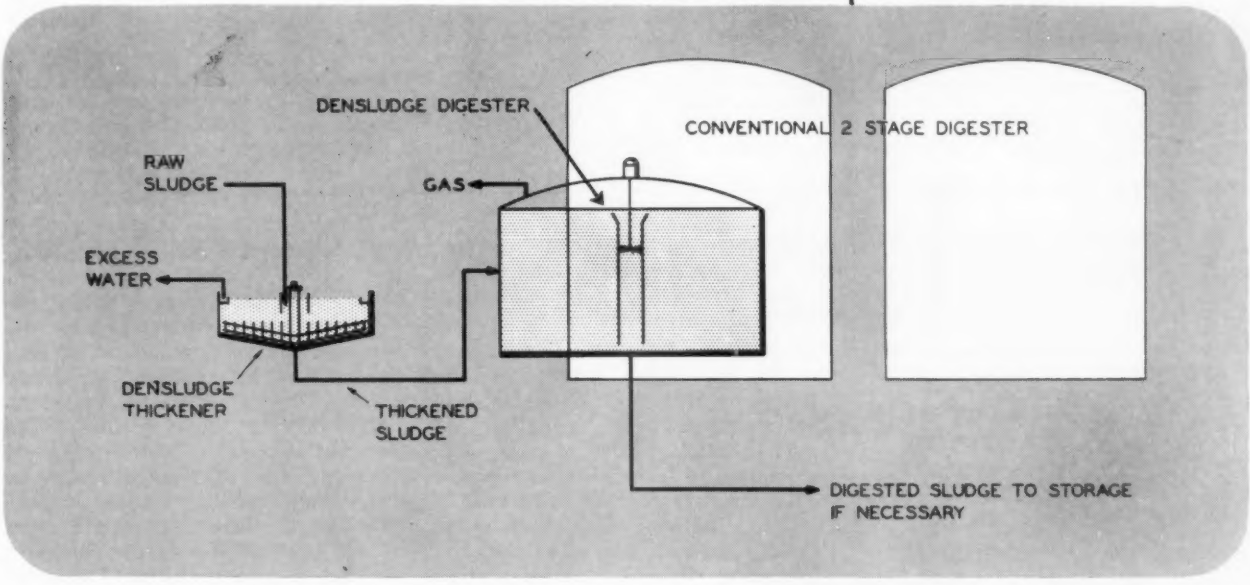
Other Articles

"Influence of **Anionic Detergents** on the Diffused Air Activated Sludge Process". Investigation made in the Netherlands indicated temporary inhibition. By P. N. Degens, Jr., H. van der Zee and J. D. Kommer, Amsterdam, Netherlands. Sewage and Industrial Wastes, January.

"Economy Through **Welding** at a Sewage Treatment Plant". By John R.

Why Digest Water?

Densludge System Cuts Digester Requirements up to 80%



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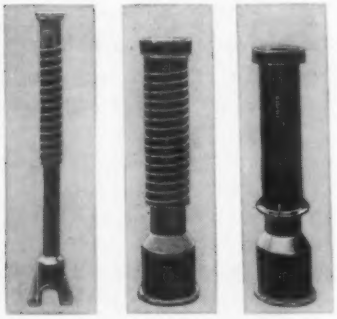

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Szymanski, Supt. of Plant, New Britain, Conn. Sewage and Industrial Wastes, January.

"Statistical Treatment of **Bacterial Data**". By Richard Pomeroy. Sewage and Industrial Wastes, January.

"Sewage and Industrial Wastes **in 1954**". Annual review. By David B. Lee, Dir. Florida State Bd. of Health. Water & Sewage Works, February.

"**Stabilization** of Polluted Waters". Fundamental principles. By H. Heukelekian, Rutgers Univ. Water & Sewage Works, February.

"**Sewage Pumping Stations**" Recent developments in planning in England. The Surveyor, Jan. 22 and Feb. 5.

"Studies of **Waste Water Reclamation** and Utilization". Result of survey by California Water Pollution Control Board. PUBLIC WORKS, March.

"Getting the **Best Performance** From Your Sewage Works"; Chapter 4. By Le Roy W. Van Kleeck, Prin. San. Engr. Conn. State Dept. of Health. Wastes Engineering, February.

"**Valuables Salvaged** From Sewage at State Mental Hospital Plant". By Lewis C. Van Huben, Rockland (N.Y.) State Hospital. Wastes Engineering, February.

"**Experiments at Reading** (England) on the Purification of Sewage and the Treatment of Sludge". Contractors Record, Jan. 19.

"The Facts About **Dual Disposal**—Garbage and Sewage". By S. L. Tolman, Jeffrey Mfg. Co. PUBLIC WORKS, March.

"**Activated Sludge** Treatment for Cambridge" Ohio. By Guy Browning Arthur. PUBLIC WORKS, March.

"Now **Pumps** Use Less Power to Handle Increased Sewage Flow." F-M angle-flow pumps at District of Columbia. By M. H. Kinsinger, Chf. Mech. Supt. PUBLIC WORKS, March.

"City-Owned, City-Cleaned **Garbage Cans**" in Hutchinson, Kans. By Cecil Bybee, Supt. refuse disposal. American City, February.

"Sewage **Treatment Odors** Squelched" at New Britain, Conn. By John R. Szymanski, Supt. American City, February.

"**Land Treatment** Is Best Disposal Method Where Space Permits". Experience with several English sewage farms. By M. A. Kershaw. Municipal Engineering, Dec. 17.

"The Utilization and Disposal of **Sewage Sludge.**" General considerations. By C. B. Townend, an English engineer. Contractors Record, **Feb. 2** and Feb. 9.

Industrial Wastes Cause Plant Operational Problems

AN excellent annual report of operation of the Cranston, R.I., sewage treatment plant for the year ending September 30, 1954 has been issued by Walter C. Anderson, Superintendent.

The total yearly sewage flow amounted to 1,385 million gallons, a daily average flow of 3.812 million gallons. This was an increase of 245 million gallons over that for the preceding year. The major portion of the increased flow, amounting to 205 million gallons, were textile wastes from the Cranston Print Works.

The sewage consisted of approximately 74 percent domestic sewage and about 26 percent industrial wastes. It had an average composition of 192 ppm of suspended solids, and 266 ppm of BOD. Expressed in terms of BOD, the total oxygen requirements of the raw sewage averaged 8,457 pounds per day, equivalent to **0.141 lb. per capita per day.**

The textile wastes were an important factor in the over-all operation of the treatment plant, resulting not only in higher costs of operation but also in a loss in plant treatment efficiency.

In an effort to reduce the pollution of the Pocasset River, into which the textile wastes were being discharged, and also, to determine if the treatment plant could handle them, increasing amounts of the wastes were diverted from the stream and discharged into the sewers. During June, 1954, a total of 47 million gallons of textile wastes were treated at the plant. Results of treatment of this volume of textile wastes, representing 34 percent of the total monthly sewage flow, indicated that the plant capacity was insufficient properly to treat these wastes. The total volume of textile wastes requiring treatment in order to reduce adequately the pollution of the receiving stream has been estimated at about 60 million gallons per month, or about 30 percent more than was treated during the month.

Primary treatment during June showed only 40.9 percent reduction of suspended solids as against 60.3 percent during normal operation when textile wastes were not entering the sewers. Similarly, the BOD reduction was only 14 percent as against 42 percent during normal operation without the textile wastes.

Complete treatment showed a reduction of suspended solids of 70 percent as against 92.9 percent during normal operation, and BOD removals showed only 83 percent for the month of June as against 90 percent during normal operation.

The effluent entering the Pawtuxet River after complete treatment showed an increase in suspended solids from 15 ppm during

operation with only normal domestic sewage to 48 ppm during the month of June. The BOD results showed an increase from 16 ppm with normal operation to 44 ppm for the month when the maximum amounts of textile wastes were treated.

Tests were made to determine if longer detention and aeration periods would be of advantage in obtaining better purification. The results of these tests were favorable and indicated the need for additional treatment units, the design and costs of which are being determined by the consulting engineers, Fay, Spofford & Thorndike.

When the maximum volumes of textile wastes were being treated, a marked decrease in the efficiency of digester operation was observed. Gas production became less and less, resulting in the necessity of taking that digester out of service, filtering the partially digested sludge, cleaning the digester, diverting the textile wastes from the sewers, and restarting the digester.

As during the preceding year, cesspool wastes have been discharged at the inlet to the grit-removal unit where the sand is separated and the remainder of the liquid wastes passed through the plant processes. A total of 1,637 loads of cesspool wastes were handled of which 519 loads were from within the City of Cranston and 1,118 loads were handled from the neighboring City of Warwick. The total cesspool wastes received during the year amounted to 2.619 million gallons which is equal to 0.19 percent of the total sewage flow. Cesspool fees amounting to $2,619.20 were received by the city treasurer. This is at the rate of $1.60 per load.

The treatment plant was in operation for a total of 8703 hours out of a possible 8760 hours. A total of 53 hours was lost due to power failure caused by hurricane Carol, and a 4-hour shutdown resulted from hurricane Edna. Except for the power failure, no damage to the plant buildings or equipment was experienced.

The total net cost for operating the treatment plant during the past fiscal year amounted to $83,426.85 which is equal to $60.24 per million gallons treated. This is an increase of $4.07 per million gallons over the cost for the preceding year. The net cost is 30 percent higher than for the previous year, and even though the volume of textile wastes amounted to only 15 percent of the total sewage flow, it does indicate the relative increase in costs for treating that volume of difficult, highly alkaline, industrial wastes.

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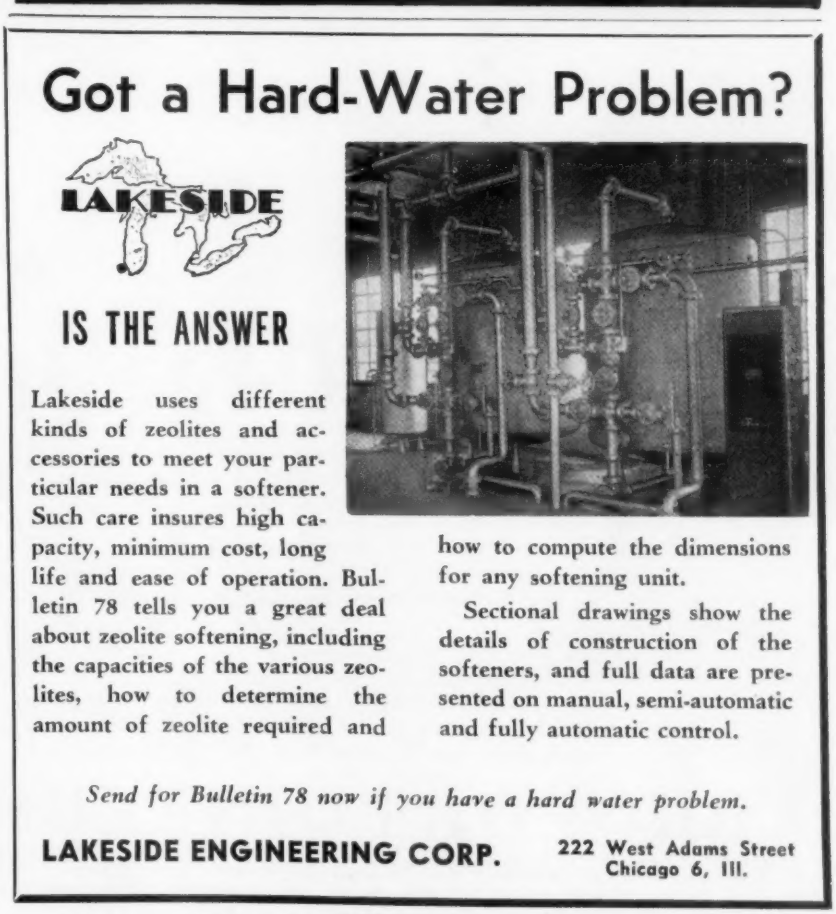
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Interstate Sanitation Commission Gets Good Results

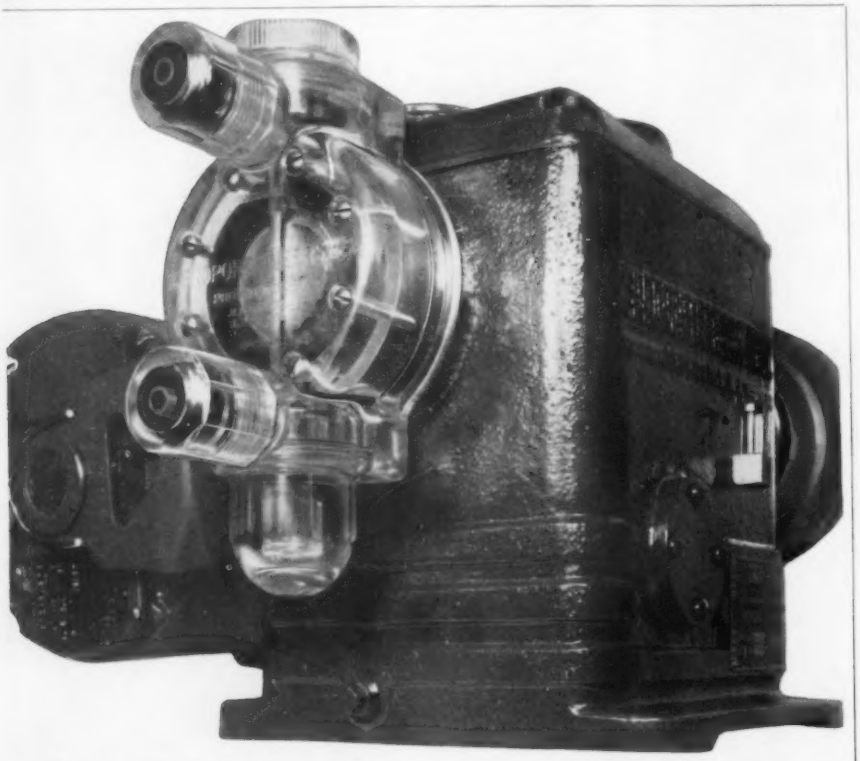
OF the several interstate commissions (not including the Federal Bureau of Public Health) entrusted with the abatement of pollution of streams and other bodies of water, none, we believe, has performed such a tremendous job so successfully as the Interstate Sanitation Commission, charged with "abating and controlling pollution which was discharged into the waters of the New York-New Jersey-Connecticut metropolitan area". This area includes Long Island sound east to New Haven, the Hudson River north to Bear Mountain, the Atlantic Ocean shore of Long Island east to Jones Beach, Staten Island, and streams entering New York Bay from New Jersey. According to the report of the Commission for 1954, there are about 120 treatment plants discharging into these waters, treating about 900 mgd, of which about 400 mgd is treated "adequately". The success of the Commission is shown by the fact that about 98 percent of the wastes being discharged from Connecticut into the waters controlled by the Commission are receiving treatment. So also are about 95 percent of those being discharged from New York State, exclusive of New York City. Over 50 percent of the wastes from New Jersey are being treated, which percentage will be greatly increased by the plant under construction at Jersey City and that under design for Hoboken. New York City has completed or has under construction plants costing approximately $145,000,000, which will complete the plants ordered by the Commission. Of the present plants in the area under the jurisdiction of the Commission, 21 are over 20 years old, and many of them should be enlarged or their efficiency otherwise increased. During the past five years, nineteen plants have been built in the area, of which three are listed as secondary, two as chemical and one as Imhoff; the remainder furnishing primary treatment only.

The cost of the plants built to date is estimated to have been about $115,000,000 in addition to those for New York City.

The Commission surveys the shorefronts of communities which have recently completed treatment plants, to determine whether there are any industries which continue to discharge untreated wastes, or where sanitary sewage has not been eliminated. It also makes periodic visits to the plants to determine whether they are meeting the detailed and specific provisions of the Tri-State Compact. The Commission, in cooperation with the U. S. Army Engineers, surveys the waters of the Hudson and East rivers and Upper New York Bay to determine the MPN of coliform organisms, pH values, dissolved oxygen saturation, BOD and chlorides.

Investigations conducted in 1953 by New York University and the Commission had indicated that pollution from cabin cruisers at anchor in protected harbors could affect the waters of those harbors as to bacteriological and aesthetic quality, and studies are being made to determine how this can be eliminated.

Seth G. Hess is Director and Chief Engineer of the Commission; Alex N. Diachishin is Asst. Chf. Engr. Each state is represented by five commissioners, of which William C. Cope of New Jersey is chairman and Daniel F. B. Hickey of Connecticut and Hugh W. Robertson of New York are vice-chairmen.



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PUBLIC WORKS DIGESTS

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Sufficiency Estimation To Determine Adequacy of Roads

Douglas County, Wis. has developed a procedure for estimating the sufficiency of its several highways which "highlights the basic fundamentals of highway construction and the present status of the system." Its object is to provide the basis for the formulation of a logical financial plan for the future development of the trunk highway system. The sufficiency goal set is to obtain a complete system of two-lane, all-weather, all-season roads, capable of carrying loads to the statutory limit of 18,000 lb. per axle. Priority of improvement should be determined by the latest available traffic count, if possible, together with consideration for school bus and commercial routes.

A chart is made for each highway, with 7 horizontal columns indicating respectively cleaning and grubbing, grading, original surface, granular base, gravel stabilizer, gravel for bituminous surface, and bituminous surface. Vertical columns indicate estimated cost of ultimate sufficiency of each construction phase, the relative cost of each phase, the length of road which fails of full sufficiency for each phase, the cost per mile of bringing each phase to sufficiency, and the total cost. The total costs for all highways furnish a solid foundation on which to base future budget requirements.

"Cost of Adequacy Revealed in Sufficiency Estimation." *Better Roads,* February.

Owning or Renting Equipment

The advisability of a highway department owning the equipment needed for specialized work or for emergency or peak-load periods is discussed by thirteen highway officials. Some believe that it is better to own such equipment: that this in the long run expedites the work and makes for better planning of maintenance and betterment projects. Others, who have had experience with renting, report that in most instances it is advantageous financially to rent. The Illinois Div. of Highways rents equipment not only for emergencies but also for routine work whenever the need justifies the rental cost. Most departments rent equipment fully furnished on an hourly basis with operators. Advantages of renting are: elimination of expensive maintenance and repair costs involved in the upkeep; equipment can be obtained as needed without a large financial investment; equipment inventories and manpower can be held to a minimum consistent with routine operation; skilled operators can be obtained without adding them to the permanent payroll. Disadvantages are: work may be slowed down because of lack of equipment; it may not be possible to obtain equipment when it is needed most; more supervision is required, and it is sometimes difficult to exercise proper control over the work.

"Rent or Own Low-Use Equipment?" *Better Roads,* February.

Specification for Soil Compaction

A member of the English Road Research Laboratory, in a paper read before the Institution of Highway Engineers in December 1954, said: "Although it is fairly common practice to specify the state of compaction required in earthworks as a percentage of the maximum dry density obtained with a standard laboratory test, i.e., as a relative compaction, this procedure has several serious drawbacks . . . It is suggested that a more satisfactory approach to the problem is to specify: (1) The moisture content (or

Concrete Pavement Widened Without the Use of Forms

WITHOUT the use of road forms, a section of US Highway 15, near Wayland, N. Y., was widened for 2.7 miles without the use of forms. A 2-ft. strip of concrete was placed on either side of the roadway. A Blaw-Knox Model 95 road widener was used, and an average of 2200 ft. per day was placed. Widening strip depth is 8 ins. Two truck mixers and an 8-man crew handled the widening work for Holmes & Murphy, Orchard Park, N. Y., the contractor. The entire width of the road will be surfaced with a 2½-inch layer of black top.

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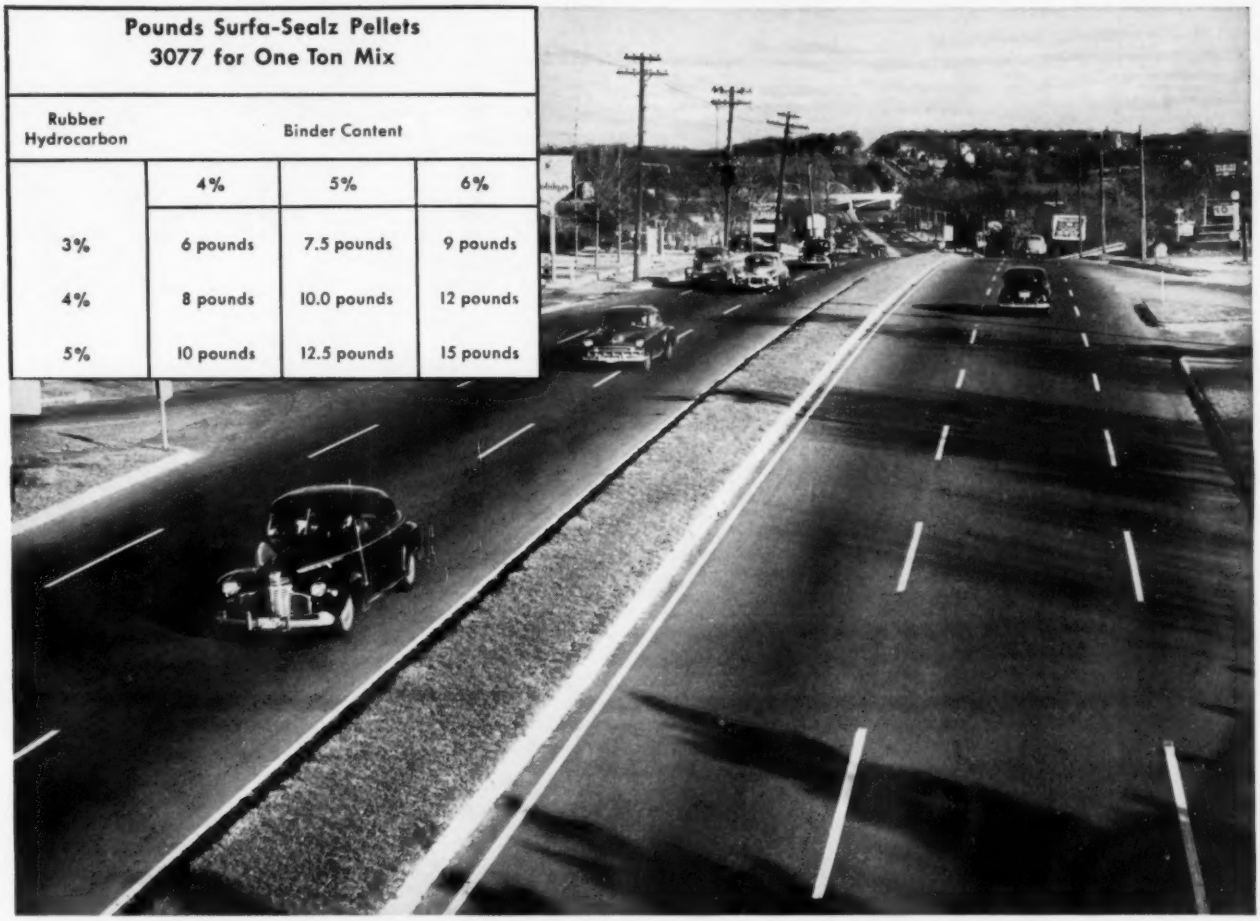

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moisture content range) at which the soil should be compacted, determined on the basis of the ideas outlined earlier in this paper. (2) The state of compaction to be obtained in the field in terms of a maximum percentage of air voids for the compacted soil (or alternatively in terms of a minimum percentage of the saturation dry density at the moisture content at which the soil is compacted)."

"Compaction of Earthworks and Performance of Plant". By W. A. Lewis, Road Research Laboratory, *The Surveyor*, January 29.

Accidents and Highway Design

A study of the effect of highway design on the occurrence of accidents is made possible by the construction of a new road on a new location replacing part of U. S. 40, which remains in use. Both are two-lane, cross the same two mountain ridges and have about the same total rise and fall; but the old road has steeper grades, sharper curves, narrower shoulders and poorer sight distances. Of 554 accidents which occurred on the two roads during the 6 years 1948 to 1953, the rates for the two roads were practically the same—1.8 per million vehicle-miles on the old road, 1.9 on the new. On curves on the old road, the rate was 3.5, as compared with 0.9 on the new. On straightaways the rate was 1.5 on the old road, as compared with 2.0 on the new road, where rear-end collisions were much more common, principally on steep upgrades.

"Effect of Highway Design on Accidents". *Public Works*, March.

Traffic Signs Reduce Accidents

El Paso, Texas, in 1953, established its first full-time traffic engineering department, the first action of which was to modernize its traffic signs, especially the "Stop" signs. It adopted the standards recommended by the AASHO and the ITE, except that it used red for the stop signs. Such a sign, placed at an important intersection, reduced an accident record of 8 for the six months previous to 1 for the six months following, and violations of the sign were practically eliminated. The city makes its own signs at a cost of $5.93 installed.

"Traffic Sign Program Reduces Accidents". By Joseph D. Nadon, Traffic Eng'r. *Public Works*, March.

Signs located strategically along "accident stretches" have been used to warn drivers to take special precautions, referring to the accident record of this particular stretch, warning of the possible ill-effects of altitude, of highway hypnosis due to monotony, etc. Guide signs giving information of the route ahead, distance to turnoffs, etc. are especially desirable on thruways and other roads where high speeds are permitted.

"Traffic Signs Make Roads Safer Now." By D. O. Opstad, Minnesota Mining & Mfg. Co. *Public Works*, March.

Tar-Rubber Hot Mix For Jet Fuel Resistance

Jet fuel dissolves asphalt, and since it evaporates slowly, it can dissolve whole sections of pavement before it evaporates. Tar-rubber pavement is being developed as an answer to the problem. Tar is practically impervious to jet fuels; oil-resistant synthetic rubber is added to overcome the tendency of tar to crack in cold weather and flow in warm. The material handles about the same as asphalt, but the hot mix comes out of the pugmill loaded with noxious fumes and a

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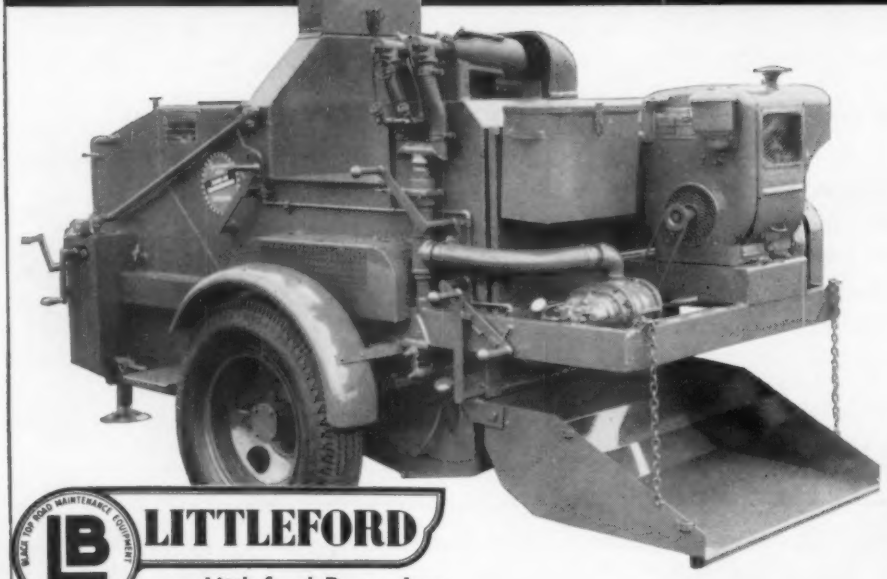

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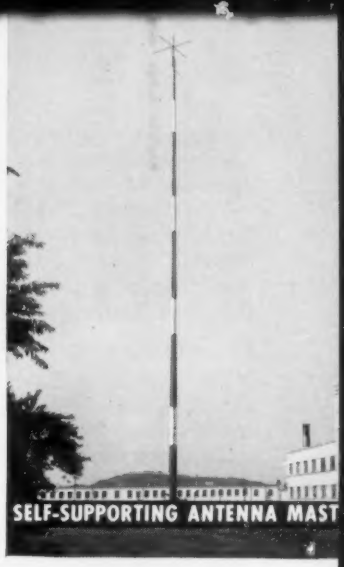

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special blower set-up is installed on the pugmill platform to protect the operator.

"Tar-Rubber Hot Mix Designed for Jet Fuel Resistance." *Roads and Streets*, February.

Calcium Chloride In Constructing Low-Cost Roads

The District of Columbia, in constructing low-cost roads, uses stage construction; 8-in. of gravel road sealed with penetration type asphalt surfacing; followed later, when conditions warrant, with a higher type surfacing. After the gravel has been compacted, the entire surface is spread with calcium chloride at about 2 lb. per sq. yd. This prevents dusting and permits opening the street to traffic during its curing period, before surface treatment with asphalt. Calcium chloride also maintains moisture control and aids in attaining maximum compaction under traffic. The minimum curing period before asphalt sealing is six weeks—it may last all winter. During the three years that this method has been in use, the cost has decreased; that for gravel in place, from $1.60 a ton to $1.37, and the cost for surface treatment from 64 cts per sq. yd. to 38 cts.

"Low Cost Stage Construction With Calcium Chloride." By Bonner S. Coffman, Soils Engineer of the District. *Roads and Streets*, February.

Non-Agitating Dump Trucks for Hauling Concrete

In concreting Ohio's $326-million turnpike, a contractor for 10 miles of it, involving 77,000 cu. yd. of paving concrete and 18,000 cu. yd. of concrete for bridges and culverts, mixed the concrete in a central plant midway of the job and hauled it in 14 non-agitating dump trucks of 4 cu. yd. capacity. The maximum hauling time averaged about 18 min. Loading time at the mixing plant, including 1½ min. mixing time, averaged 1¾ min. Discharge time at the job averaged 1 min.

"Ingenuity Paid Off on Ohio Turnpike". *Engineering News-Record*, Feb. 10.

Culverts Replace Bridges

In reconstructing a part of U. S. 10 in Montana, six timber bridges were replaced with corrugated culverts. In one case, twin multi-plate pipe arches under 7 ft. cover replaced a 76-ft. bridge. In other cases a 120-in. multi-plate pipe under 17-ft. cover replaced a 114-ft. bridge; a 180-in. pipe under 32 ft. cover replaced a 152-ft. bridge; and a 150-ft. pipe under 57 ft. cover was used in another case. These bridges had been built 10 to 20 or more years ago with a specified capacity inadequate for modern traffic. It was considered that a fill will take any conceivable load and insure uninterrupted flow of traffic.

"Bridges Go As Engineers Realign Highway". By Oscar Ostenson, Construction Eng'r. *Engineering News-Record*, Feb. 24.

Coated Materials For English Roads

About 80 per cent of the road surfaces in England are covered with materials coated with tar or asphalt, 10 per cent are of "asphalt proper", and the remaining 10 percent include concrete, waterbound surfaces, stabilized soil and other. The aggregates used include crushed rock, slag, and gravel. Fillers added to the mix include limestone dust, cement, hydrated lime, and sand. The British Standards Institution has prepared standards for each of these materials and for mixing

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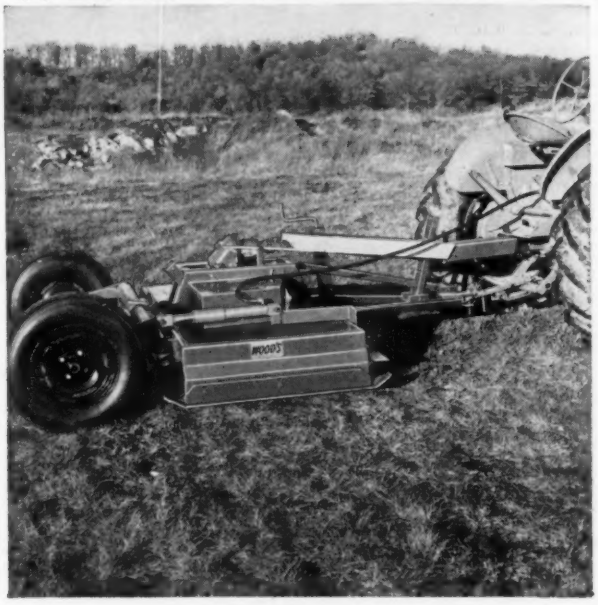

MODEL 80 (61 similar)

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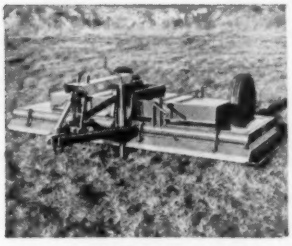
Wood's PTO-operated tractor rotaries do a clean and even job of mowing grass down to an inch high or cutting thick waist-high brush. Easy and accurate adjustment is handy on all models.

There are 12 models available in hydraulic lift or drawbar pull-type for any size tractor—42″ to 114″ cut—adjustable from ground to 14″ high. Wood's cutters mow, clip or shred and mulch leaves—close to trees, fences or buildings.

There are 1, 2 and 3 blade models. Blades overlap for clean cutting. Equipped with shock absorbing V-Belt drive, 3/16″ boiler plate housing, 15″ drop-center wheels or 8″ with non-pneumatic tires. All working parts enclosed.

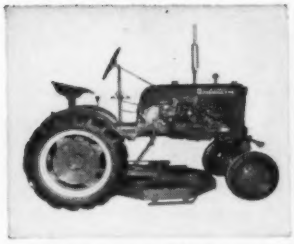
Large Selection of Models

Model 42C, 42A—42″ cut, single blade, for Farmall Cub and Super A. **Model 42F**—Same as 42C but rear-mounted for the Fast-Hitch Cub. **Model 5**—60″ cut, single blade, for 2 plow tractors. **Model M5**—Same as 5 but mounts on 3-point hitches such as Ford. **Model 61**—61″ cut, double blade, for 2 plow tractors. **Model M61**—Same as 61 but mounts on 3-point hitches. **Model 80**—80″ cut, double blade, for 2-3 plow tractors. **MODEL O-80**—Same with off-set drive for working under low trees. **Model M80**—Same as 80 but mounts on 3-point hitches. **Model 114**—114″ cut, triple blade, for 3-4 plow tractors. **Model 114E**—Same as model 114 but with mounted engine for use with small tractors.



MODEL 114

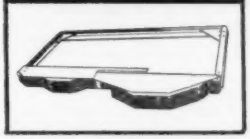
MODEL 5

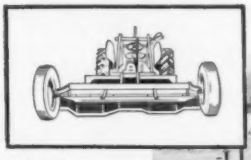


MODEL 42C (42A similar)

MODEL M80 (M61 similar)

LEAF MULCHING ATTACHMENT





Leaf Mulcher available for Models 42F, 42C, 42A, 61, M61, 80 and M80.

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them. The present standards are described in this article.

"Coated Materials", By W. F. Morris. *Contractors Record*, Feb. 2.

Advancements In Concrete Paving

This article describes briefly several recent advancements in constructing concrete pavements. They include air entrainment, and granular subbases (which prevent pumping) as perhaps the two most important. Others are sawed joints, traveling form pavers, uniformity of pavement thickness (only two states now thicken the edges); soil cement subbases; lane separators, and reflecting curbs; precast, prestressed highway bridges, and prestressed highway slabs.

"New Advances in Concrete Pavement Add Further to Heavy-Duty Performance. *Public Works*, March.

Other Articles

"Sometimes **Tar**—Sometimes Asphalt" used for paving in Lewiston, Maine. American City, February.

"**Accounting for Equipment** Control" in the California Div. of Highways. By John C. Tibbitts, Chf. Clerk. American City, February.

"**Evaluation of Capacity** to Execute Expanded Capacity" required by the $101-billion program. Better Roads, February.

Joints in Concrete Roads. ("Voegen in Cementbetonwegen"). General discussion of theories and practices. By C. van de Fliert. Wegen, January.

"New Procedures for Prepaving Current and **Final Estimates**" in Pennsylvania. By C. H. Buckius, Chf. Eng'r. Roads and Streets, February.

"California Leads in **Free Expressways**". By George T. McCoy, State H'way Eng'r. Roads and Streets, February.

"**Mixing Bituminous** Road Materials." British practice for obtaining uniformity. By H. G. Barnes, Road Research Laboratory, England. Roads and Road Construction, January.

"Massachusetts Favors **Contract Method** in Maintaining Roads". By John A. Volpe, Com'r. The Constructor, February.

"**Mechanical Stabilization**" of soils. Fifth of a series. By H. Brooke-Bradley, Deputy County Surveyor, England. Municipal Engineering, Feb. 4.

"**Compaction of Earthworks**". By W. A. Lewis, Road Research Laboratory, England. Highways and Bridges. Jan. 26 and Feb. 2.

"Conditioning a Portland Cement Concrete Pavement for **Hot Mix Resurfacing**". By F. W. Kimble, Ohio Dept. of H'ways. PUBLIC WORKS, March.

"**Seal Coating** for Airfield Flexible Pavements". Investigation by Navy and Army to prevent "flushing up". PUBLIC WORKS, March.

"**Bituminous Stage Construction**" in South Dakota. By Earl Coyne, H'way Supt., Aberdeen. PUBLIC WORKS, March.

"**Roadside Planting** Regulations Adopted by North Carolina", for planting by private individuals or state employees. PUBLIC WORKS, March.

"**Air Tools** Save Money on Road Construction" by a Pennsylvania contractor. PUBLIC WORKS, March.

"**Radio Control of Traffic** Planned for Chicago". Electronic system to control traffic signals. PUBLIC WORKS, March.

"Twenty Years of Highway Department **Radio Experience**", in the State of Washington. PUBLIC WORKS, March.

"**Mercury Vapor Lights** for Jacksonville Bridge". By C. E. Wright, PUBLIC WORKS, March.

"How Evanstonians Keep Their City Clean". **Street Cleaning** methods. By Phil Hirsch. PUBLIC WORKS, March.

"Getting Adequate Roads for Alabama Includes **Bridge Renovation**". By W. G. Pruett, State Highway Eng'r. PUBLIC WORKS, MARCH.

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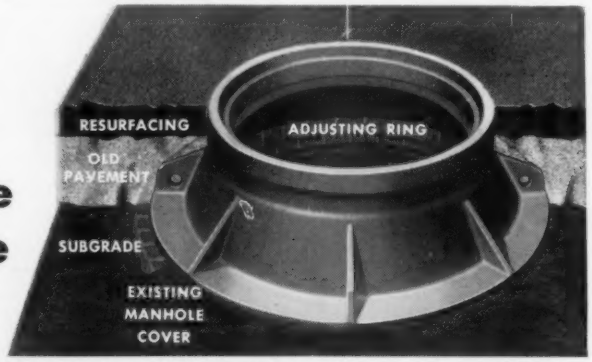
then save money with the original NEENAH manhole adjusting rings



Adjusting ring added to existing manhole permits resurfacing for as little as 20% of the cost of replacing or raising existing frame.

Neenah Foundry adjusting rings boost manhole cover flush with refinished roadway surface — may save as much as 80% of cost of digging and resetting to new grade. Cutaway view shows old manhole frame still in place after resurfacing — thanks to the addition of a Neenah adjusting ring. Available for square and rectangular frames and in standard and special sizes.

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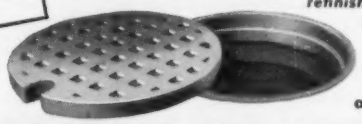
Type B adjusting ring with flared outside surface.



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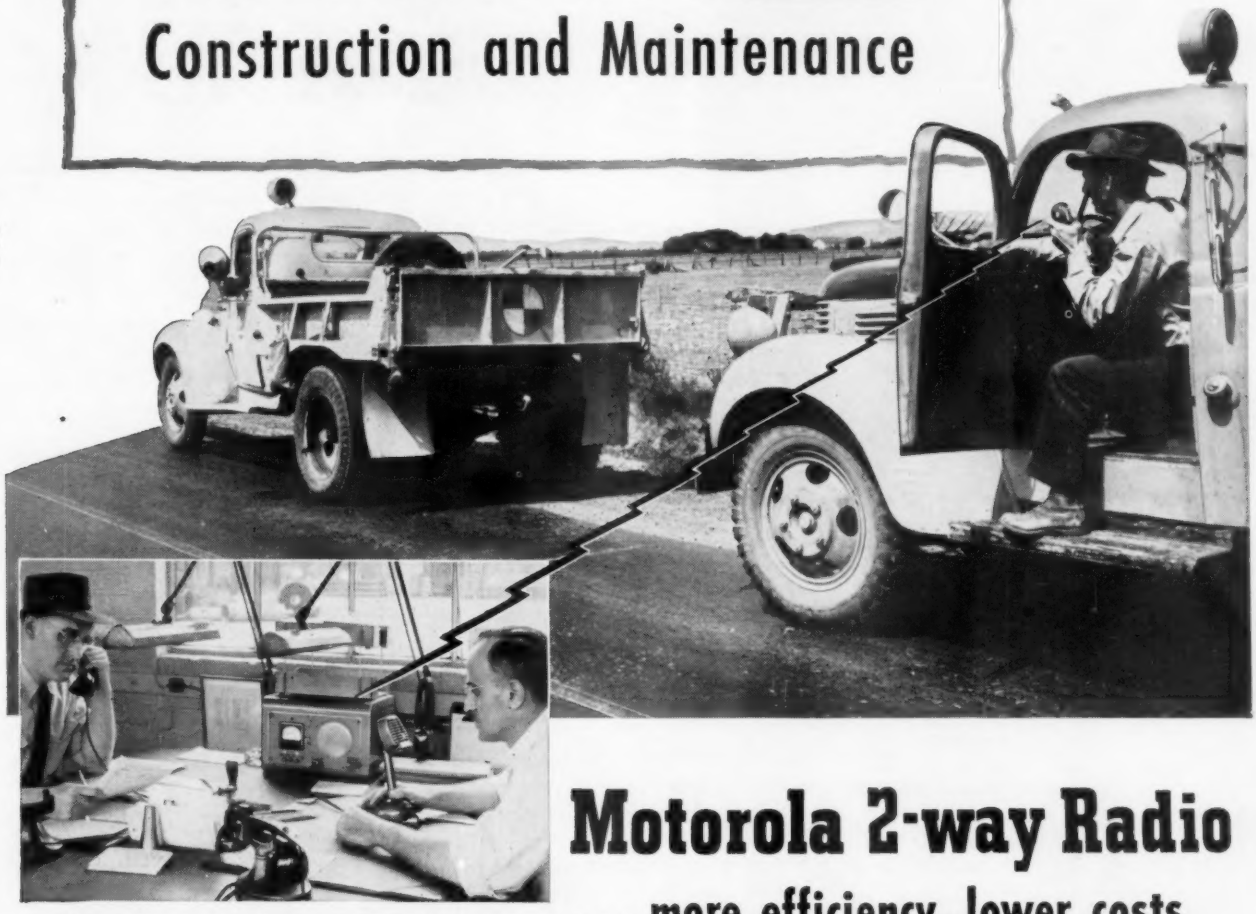

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PUBLIC WORKS DIGESTS

The WATER WORKS Digest

Financing Reasonable Water Service

"The water works industry should provide a service which is consistently and continuously available, even at peak demands and in anticipation of the requirements of expanding geographical areas"; including modern water-using devices and use for gardening purposes. Of the major sources of revenue of a water works system—general taxation, special assessments, and water rates—the third has been almost the only one employed, but was never sound or equitable. The mere presence of a water works in a community is of value to all of the taxable property, which should share a reasonable part of the cost. It is undesirable to finance extensions to serve suburban developments by issuance of general obligation bonds against the general credit of the city, and the use of revenue bonds is an appropriate method of handling the situation.

"Providing Reasonable Water Service". By Abel Wolman, Johns Hopkins Univ. *Journal of the AWW Ass'n.*, January.

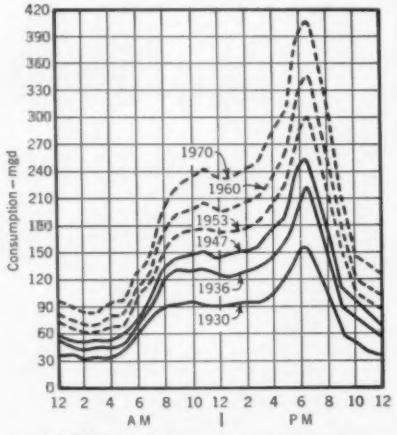
Tokyo's Large Concrete Dam

Tokyo, Japan, the third largest city in the world, installed its first water supply system three hundred years ago, taking the water from the Tama river. Other streams were added as consumption increased. In 1932 a project for constructing a large dam and reservoir on the Tama river was adopted. This, the Ogochi dam, is a straight, gravity-type dam containing 1,990,000 cu. yd. of concrete, 489 ft. maximum height, 1132 ft. long. Preliminary operations were started in 1936 and discontinued in 1943 because of the war. Much of the concrete mixing and placing plant had been used in the construction of the Hoover Dam. In 1948 work was resumed, with an extension of the original plan to include a rapid sand filter plant, 4 hydro-electric plants to generate an annual total of 320 million kwh, and provision for controlling floods. The total cost of the project is estimated at $59,600,000.

"Ogochi Dam Provides New Water Supply for Tokyo". By Maurice M. Class, *Civil Engineering*, February.

Peak Demands At Milwaukee, Wis.

From 1920 to 1953 the population of Milwaukee supplied with water increased 50 percent and the peak consumption increased 250 percent for the city as a whole, but more in some sections than in others. About 20 years ago the city adopted the plan of utilizing large steel standpipes as reservoirs to be filled at night under normal pressures, and pumping this water into the system during the peak demand period. This allows more uniform operation of the pumps at the major stations, and of the filter plant, and decreases the required capacities of the pumping mains, and better pressures are maintained in the outlying areas. The city is now installing a system of large storage units, their capacities being based on consumption charts for peak days during the past several years; the rate of increase in consumption for each hour of the day in the past is used to determine the probable peak-day graph for a distant year.



● **HIGH-SERVICE peak days. Pump capacity was 268 mgd in 1954 and will be increased to 312 mgd in 1955.**

"Meeting Peak Demands at Milwaukee". By Edward F. Tanghe, Supt. of WW. *Journal AWW Ass'n.*, January.

New Dam At Flint, Mich.

Flint, needing an increased water supply in 1924, considered damming the Flint river, but found that a topographical survey of the broad, shallow valley would take much of the money available, and a smaller stream was dammed instead. By 1945 this supply became insufficient and again the Flint river was considered. And as a complete topographic survey by aerial methods was now possible at much lower cost, such a survey was made in 1947, and a dam was built in 1953 to raise the stream 28 ft. and create a lake 10 miles long, storing 5,760 million gallons. This is an earth filled dike a half-mile long with a center controlled section 240 ft. wide made up of three 20-ft. Tainter gates which may be set individually at two fixed heights with a variation of 4 ft. At each side are two 90-ft. floating drum gates which automatically rise with the water or can be lowered by flooding the flotation chambers. Fine control is provided by two sluice gates. This dam, in addition to supplying the city with water, assures a constant river flow sufficient to carry away the discharge from the sewage disposal plant below the city.

"Air Maps Reduce Water Supply Survey Costs". *Public Works*, March.

Removing Manganese, Color and Odor

The U. S. Penitentiary on McNeil Island, Wash., containing about 1600 persons, obtains its water supply from surface water impounded in reservoirs during the rainy season. Dams on three small streams impound water, which is pumped to

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a large artificial lake in the center of the island holding 700 m.g. The discharge from this flows to another 24-mg lake. The potable supply is drawn from the lower lake and treated; irrigation water is drawn from the upper lake. The treatment is designed to remove color, iron, manganese and swampy tastes and odors. Algae control is practiced at the lower lake by use of copper sulfate. Water is withdrawn from the lake as near 8 ft. below the surface as possible; below 12 ft. depth the water is devoid of free oxygen in summer, is very high in iron and manganese, and the odors are severe; while at the surface the algae oils are greater. In the filtration plant, manganese is removed by adding chlorine dioxide with chlorine. If all the manganese has been oxidized as the water enters the mixing basin, the alum floc will remove it. Color can not easily be removed with alum alone; up to a certain point chlorine can be substituted for alum; color in the solution form is most easily removed by oxidation with chlorine. Odor caused by algae or decaying vegetable matter is removed with chlorine and chlorine dioxide. Chlorine dosages are determined solely by odors at a hot water tap, not by chlorine residual.

"Water Treatment Removes Manganese, Color and Odors." By C. R. Harlock, Supt., and M. R. Dowlin, Operator. *Public Works*, March.

Automatic Control Of Fluoridation

A method has been developed for continuously monitoring the fluoride content of the water treated in the North Beverly, Mass. filtration plant of the Salem and Beverly Water Supply Board. After more than 18 months of experience during which methods were found for minimizing interference with accurate operation caused by temperature, and the presence of lime, calgon, chlorine and aluminum in the water, and mechanical and electrical "bugs", the equipment has been found to provide a satisfactory method for accurately controlling fluoride doses. Electrical conductivity is the basis of the method for measuring the fluoride content of the water before and after the fluoride has been added. The cells used to measure this are connected to a difference recorder and controller unit.

"Fluoridation by Automatic Control". By Kenneth F. Knowlton, Supt.-Chemist. *Water & Sewage Works*, February.

Cooperation of Governmental Units

Four papers in the January issue of the AWWA Journal are devoted to presentation of reasons why there should be cooperation between the many governmental units in trying to solve the problem of fininshing reasonable water service to their several communities, and illustrations of such cooperation in Kentucky, Manitoba, Texas and Michigan. Said Edward C. Harding: 'There were 115,113 governmental units (federal, state, county, township, municipal, and district) in the United States in September 1952. In Kentucky alone there were more than 800 such units. Thus, practically every governmental agency and function will, sooner or later, collide with others," especially in the case of small communities—towns and cities that do not command the means, resources and prestige to extend streets, sewers, water lines, and transportation facilities on their terms, but must negotiate, compromise, and persuade their neighbors to cooperate. Such cooperation has resulted in many cases in the formation of sanitation districts and water

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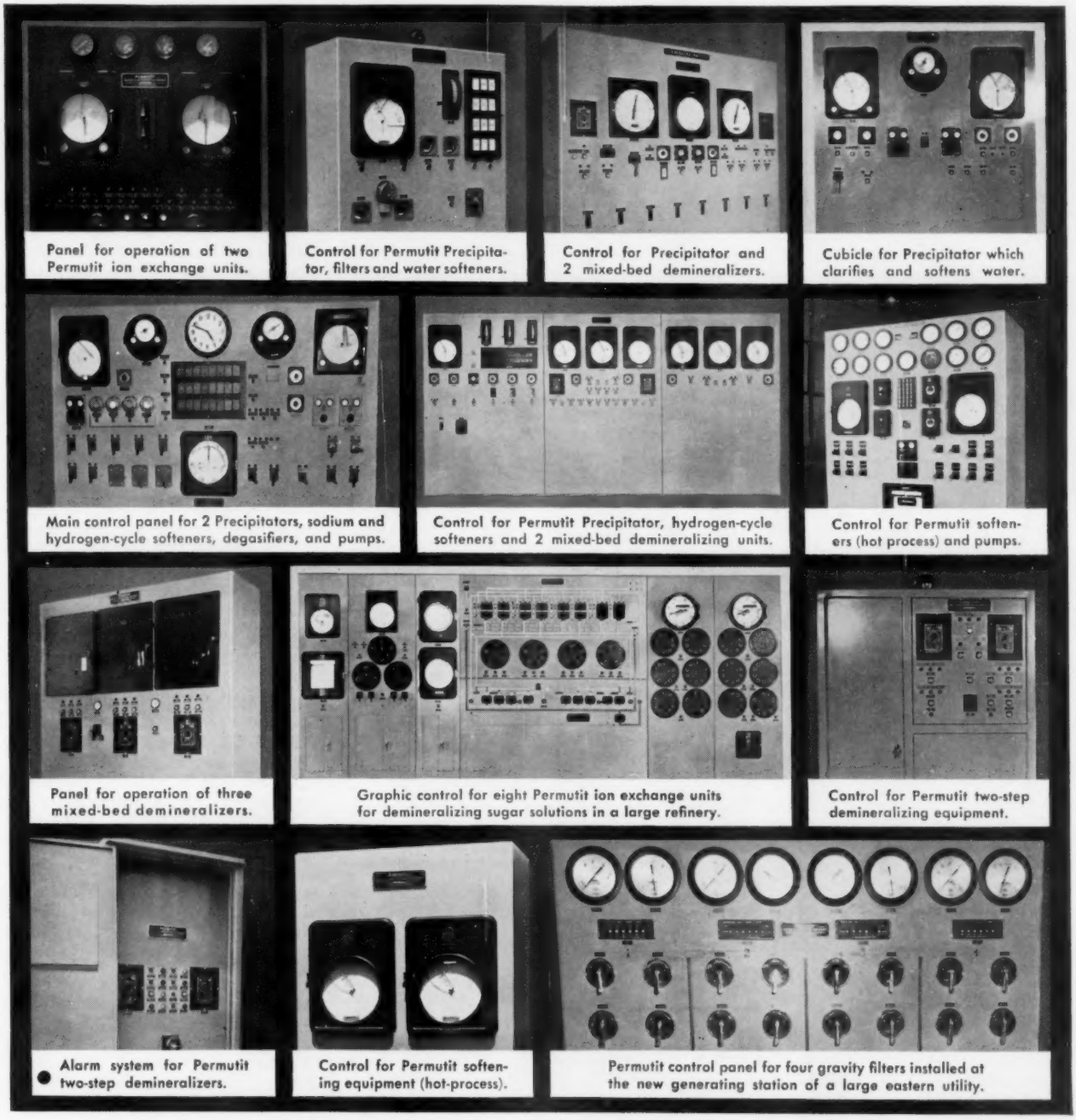

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Control for Permutit softeners (hot process) and pumps.

Panel for operation of three mixed-bed demineralizers.

Graphic control for eight Permutit ion exchange units for demineralizing sugar solutions in a large refinery.

Control for Permutit two-step demineralizing equipment.

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Control for Permutit softening equipment (hot-process).

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districts. Mr. Harding describes at length the formation and operation of the Northern Kentucky Sanitation District, which serves 17 cities and military reservations.

The "Organization and Operation of the Greater Winnipeg Water District" is described by Harold Shand, Asst. Gen. Mgr. of the District. This furnishes water to nine municipalities.

Austin, Texas has the only adequate water supply in its metropolitan area, and furnishes water to communities in the fringe area, but only if they organize into water districts. According to Texas law, such districts are independent governmental entities, but in practice they are completely subordinate to the city, which contracts to furnish water only if the water facilities are such as to fit into its system plan when the city later annexes the community. Meantime, the city operates the local systems as part of its own, except that each district pays for the water that is furnished to it and collects from its own citizens. This plan is described by John Gillespie, of the Univ. of Texas.

The problem presented by the smaller communities in Southeastern Oakland County, Michigan, was different and a different solution was worked out. Here the communities cooperated under their own initiative, hired engineers to report on available sources of supply, financial and legal requirements and possibilities, etc. In 1952 the State legislature passed an enabling act under which seven communities formed a "Water Authority". This contracted with the city of Detroit to furnish the water, and is constructing the necessary mains, pumping plants, and elevated tanks, estimated to cost $6,000,000. This is described at length by George G. Schmid, Engr.-Mgr. of the Water Authority, in the article "Formation of Southeastern Oakland County Water Authority." These articles appeared in the *"Journal of the A.W.W. Ass'n.*, January.

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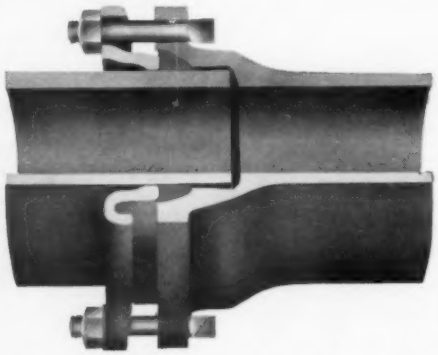

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Other Articles

"Michigan Water Works **Operating Data** for 1953". By Claud R. Erickson, Bd. of Water & Elec. Light Com'rs. Journal AWW Ass'n, January.

"Selection of High-Lift **Pump Motors and Controls**". By A. C. Michael and G. I. Stormont, Dept. of Water Supply, Detroit, Mich. Journal AWW Ass'n, January.

"History of **Steam-Operated Pumps** at Philadelphia". By Gerald E. Arnold, Gen'l Supt. Water Dept. Journal AWW Ass'n, January.

"Problems of Rapid **Population Growth** in Florida". By Charles E. Richheimer. Journal AWW Ass'n, January.

"**Quality of Arizona** Municipal Supplies". By George W. Marx, State Dept. of Health. Journal AWW Ass'n, January.

"Modern **Water Rates**" in ten cities. American City, February.

"How a **Small City** Solved Its Water Supply Problems". By L. F. Koberlein. PUBLIC WORKS, March.

"**Rapid Sand** Replaces Slow Sand Filter at Wilmington, Del." By W. Compton Wills, Chf. Eng'r. Water Works Engineering, February.

"Effect of **Microorganisms** on Lengths of Filter Runs" on **Chicago's Filter** Beds. By John R. Baylis, Eng'r of Water Purification. Water Works Engineering, February.

"**Elementary Chemistry** for Water Works Operators", Chapter 10. By Martin E. Flentje. Water Works Engineering, February.

"**Ultraviolet Rays:** The Part They Can Play in Water Sterilization". Municipal Engineering, Jan. 28.

"**Distribution System** Design and Construction". By George E. Symons. Water & Sewage Works, February.

"Tale of Two **Standpipes**", each 150,000 gal. capacity, side by side, cost only $4,000 more than one 300,000 gal. one, at Augusta, Maine. By S. S. Anthony, Supt. Water & Sewage Works, February.

Street Maintenance

(*Continued from page* 107)

indicated by the equipment for 93 employees: 17 trucks, 5 compressors, 13 concrete mixers, 3 power saws, 1 skip loader, 11 trailers, and 41 miscellaneous items. During the past year the section built 258,000 square feet of concrete gutter and 77,000 square feet of sidewalk. Besides this it had 120 bridge repair jobs, 3 tunnel repair jobs, and others on guard rails, stairways and traffic islands. It replaced 4000 street name signs and repainted 50,000.

District Maintenance. In three areas the work is done by District organizations which cover the whole range of jobs. These are the North, South, and San Fernando Valley Districts. About 550 employees have nearly 400 units of equipment similar to those listed for the other sections.

The *Equipment Repair Section* is the last of the work units in the Street Maintenance Division. It controls the purchasing, maintaining and disposing of the entire equipment fleet of 1166 units worth $3,300,000. It also controls the inspection and maintenance of buildings and fencing in 21 yards, the 3 asphalt plants, and 10 city-owned disposal sites having a book value of $1,000,000. The shop has 119 employees, 63,000 sq. ft. of working space, and equipment valued at $600,000. Three field lubrication crews work at night and on Saturday, serving all field equipment.

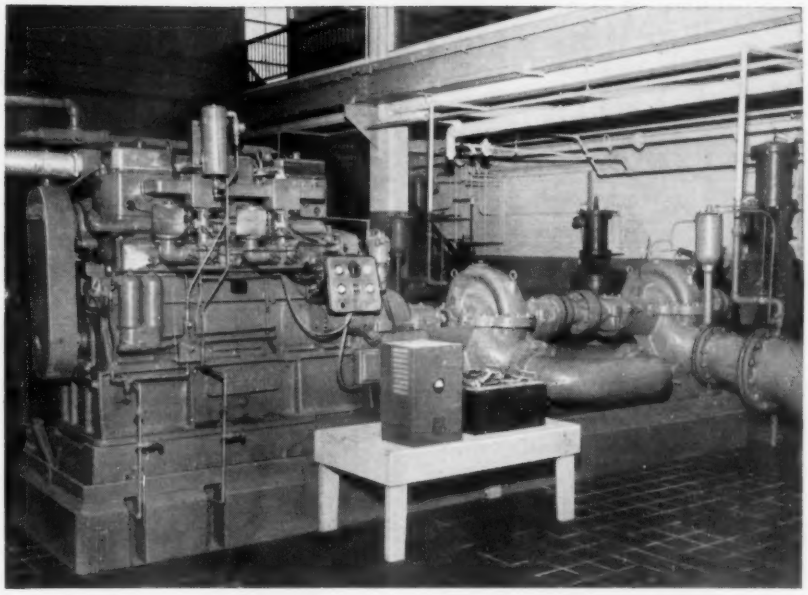
This shop designs and manufactures many pieces of special equipment requested by the superintendents. It has all the facilities, in machines and equipment, for its wide range of work.

This section has charge of the central warehouse which covers 71,000 sq. ft. of floor space, furnishing materials, parts and supplies to all yards. An inventory of 5200 items, valued at $100,000 is maintained. The annual turnover is worth about $500,000.

Other Divisions

It is the business of the *Lot Cleaning Division* to destroy weeds on vacant lots, and dispose of all kinds of rubbish found in such places. Weeds are disced or burned off. Unimproved streets and alleys in about 450 locations were cleaned last year, and 650 others were cleaned for other governmental agencies.

There are 10 field crews using 13 crawler-type and 4 wheel-type



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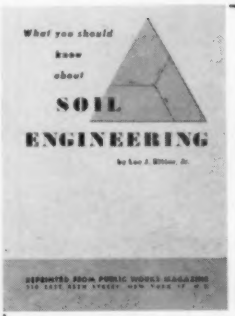

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tractors, 19 dump trucks, and accessory equipment for discing and mowing. During the year 34,000 vacant lots were cleaned, and 714 truck loads of rubbish were hauled to dumps.

The *Street Use Inspection Division* has the most unusual assortment of work, with responsibility for protecting the public ways for ordinary uses. It issues permits for moving houses, and for over-loads, bill boards, benches in parks and on the streets, blasting, and banners over streets. It took 4600 photographs in a year to show conditions, and sent out 5800 notices to repair this or that.

Its personnel consists of 28 street-use inspectors, with a Chief Inspector, and 10 blasting and house-moving inspectors.

General

This Bureau of Street Maintenance has some unusual things to do. In the complexities of annexation, the city came into possession of an abandoned oil field in which some wells still flow in negligible quantities. When a street passes over one of the old wells the casing is cut off below grade. A drain line is installed to carry the oil to a specially constructed sump off the right-of-way. Periodically the Bureau contracts with some salvage company to pump the oil out of the sumps.

But "Exhibit A" is the system of canals which were the "streets" of Venice. Long ago this town was laid out on the coast to imitate the canal city of Venice, Italy. Until Los Angeles annexed it over 30 years ago, gaily costumed gondoliers poled their flower-bedecked gondolas through the canals. These abandoned "streets" are now faithfully maintained by the city, though this maintenance consists chiefly of dragging up dunked hot water tanks, garbage cans, boxes, baskets and crates, brush and miscellaneous garbage. One small, unromantic barge manned by a crew of two dusky colored men who, in imagination, might be the crooning Italian gondoliers of another day, works through the canals once a week.

The Bureau inspects all bridges over the canals once in 6 months. The vehicular bridges are concrete, humped so high over the water that the driver of a car on one side cannot see a car approaching the narrow passage.

But the foot bridges are marvels of truss design, nameless as to type, with a plethora of planks bolted to-

gether to form the chords in the camel-back motif, and a multiplicity of wooden struts and ties in the head-high sides. These foot bridges are museum pieces, and should be studied and analyzed as required work by engineering classes working on stress diagrams.

• • •

Detroit Limits Outside Sale of Water

The manager of the Detroit Department of Water Supply, Lawrence Lenhart, has recommended to city council that no more suburbs be permitted to get water from the Detroit system. The report, requested by council to see if increases in the sale of water would violate home rule provisions, showed that present outside sales amounted to 24 percent while home rule provisions place a limit of 25 percent on water sales outside the city.

• • •

Starlings Are A Problem On Bridge

District Engineer H. M. Brush of the Missouri Highway Dept., hopes that the problem of roosting starlings has been solved. Starlings by the thousands have been roosting on a bridge creating a veritable menace. Using the principle that the call of a starling in distress will cause other starlings within hearing to figure it is time to take off, David Beatty, Paul Beatty and Ronald Phillips set to work. They made a recording on high fidelity sound equipment of four birds which were held upside down over a microphone. On the chilly night of January 10 these three young men climbed to the top of the structure above the bridge carrying a tape recorder, three loudspeakers, an amplifier, and several spools of electrical wiring.

After 10,000 or so starlings finally settled, the switch of the recorder was touched and a great volume of screeching burst from the loudspeaker. With shrill cries of their own, the starlings rose as they heard the distress signals. Four times they returned and were chased away again. At the end of fifty minutes it appeared that they decided to spend the night elsewhere.

It is reported that if a starling's roost is made untenable for several nights in succession it will finally desert it for other quarters. Maybe they will move over to the Paseo bridge or the Hannibal Bridge—but

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it has been demonstrated that starlings can be mightily agitated.—Missouri Highway News.

• • •

Washington News

(*Continued from page* 113)

Tennessee. It provides for increased Federal appropriations of $1.6 billion per year, as compared with the present allocations of $875 million per year. Uncle Sam would put up two thirds of the funds for the interstate system under the Gore Bill.

Public Works Advance Planning

In his "Economic Report to the Congress," for 1955, President Eisenhower told the Congress that experience with three advance planning programs for public works within the past decade "indicates that the need for preparedness, being itself continuous, is not well met by programs of limited duration." He recommended that the "Congress enlarge substantially the appropriation for planning advances and that a revolving fund be established for that purpose. The President's Budget carried an appropriation of $8.5 million for interest-free loans for the advance planning of public works. This is an increase of $7 million, over the $1.5 million appropriated last year.

In his "Economic Report" he again stressed the need for a U. S. Office of Public Works Coordinator. He said, "The experience gained by the Council of Economic Advisors in surveying the Nation's (public works) needs and planning for public works has confirmed the wisdom of the many students of government who have repeatedly urged systematic attention to public works planning. To emphasize this vital activity and give it larger scope, an appropriation is being requested of the Congress to set up an Office of Coordinator of Public Works Planning, within the Executive Office of the President."

Prospects are excellent for establishment of the Office. Mr. Eisenhower told the Congress that "the enlargement of our public assets is a vital task in the era ahead." The work of the soon-to-be-created Office is viewed as threefold: (1) coordination of the public works activities of the numerous Federal agencies, (2) stimulation of advance planning by States and communities; (3) cooperation with State and local agencies engaged in public construction activities of all types.

Water Pollution Control

After a year-long study, the Department of Health, Education and Welfare has sponsored Administration bills in the field of Water Pollution Control. The bills have been introduced by ranking Republicans on the House and Senate Committees on Public Works (Senators Martin, Duff, Knowland and Kuchel; Congressman Dondero). The Administration's plan eliminates all provisions for direct financial grants or loans for sewage treatment plant construction. Emphasis is placed on research, surveys, cooperation with State and Inter-state pollution control agencies and administrative-legal procedures for dealing with chronic polluters of interstate streams.

HEW Secretary Hobby told a recent Washington press conference that the new approach replaces "the limited and non-implemented construction loan provisions," because "the responsibility for constructing pollution abatement facilities rests with the cities and industries creating the problem. The ultimate abatement of water pollu-

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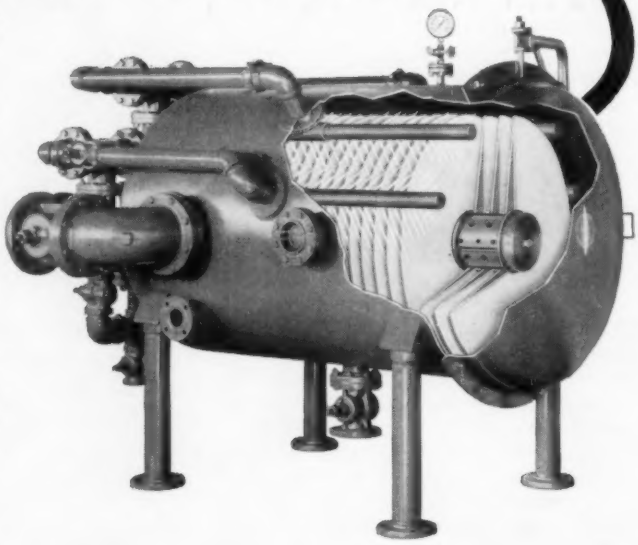

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tion must continue to depend upon local initiative and responsibility," she said.

The Administration, however, does not seem to be unaware of the problem. In a special report accompanying the new proposal the Secretary said, "Current requirements for municipal sewage treatment facilities alone are estimated to be about $2.5 billion. Current levels of municipal construction will have to be doubled to care for obsolescence, new sources of pollution and backlog."

• • •

Civil Defense Center

(*Continued from page 99*)

masonry bearing walls designed to collapse in the event of atomic blast. The basement of the building is designed to withstand the impact of the collapsing structure above; and, in addition, the loads of the shock waves following an atomic blast.

Structural design data for the control center area was obtained from the United States Civil Defense Publications TM-5-3, "Interim Guide for the Design of Buildings Exposed to Atomic Blasts" and TM-5-4, "Windowless Structures—a Study of Blast Resistant Design".

Blast loadings for the basement area are those expected from a 20KT nominal A-bomb exploded at height of 2,000 feet and at a horizontal distance of 2,600 to 5,600 feet from the structure. Under these conditions the building is considered to be in the "B" zone of blast intensity.

The location of the control center portion of the building underground and approximately four miles from the fringe of what is considered to be the target area, affords reasonable assurance that the effects of larger and more destructive bombs could be withstood.

The first floor slab, or roof of the basement, will resist a dynamic or instantaneous vertical blast load of 2,740 lbs. per square foot, or 19 lbs. per square inch, over a time increment of 0.0025 seconds, followed by a suction load of 1700 lbs. per square foot, or 13 lbs. per square inch.

Following the completion of the preliminary plans, the firm of Smith, Hinchman, and Grylls was engaged by the City of Detroit, upon recommendation of the City Engineer, to prepare the necessary plans and specifications for construction of the building.

While adhering to the goal of providing a strictly functional building

adequate to do the job, but with no unnecessary frills or appurtenances, it was nevertheless necessary to exceed the proposed cost limitation. The lowest bid for construction of the building was $311,200.00. The Federal Government will pay 50 percent of the cost of the basement, or control center portion of the building, under the matching fund program.

The building is located outside of the critical target area, but still within the city limits. The selection of this site on city owned property avoided additional expense for land acquisition.

Heating of the building is provided by an oil fired hot water boiler with a 3000-gallon underground fuel oil storage tank. Located in the boiler room is an 80-K.W. diesel engine electric power generator with automatic emergency transfer switch to cut in the emergency power when the normal electric power supply fails. This generator is capable of supplying electric power necessary for lighting the control center, supplying power for radio equipment, and supplying power for the mechancial ventilating system which supplies fresh air for the basement portion of the building.

Bell telephone lines enter the building underground at different locations and connect to several telephone exchanges. Provisions have been made for 50 telephonists to receive emergency telephone calls in case of disaster.

A 250-foot tower has been erected adjacent to the building, which provides antennae for six radio channels essential to the civil defense communications system. Transmitters for these radio systems will be located within the control center.

Within the basement control center area a partitioned space is assigned to each civil defense service. Adequate facilities are provided so that it is possible for each service to operate under emergency conditions from the civil defense headquarters in the control center.

It is planned that the heads of each service will confer with the Civil Defense Director and his staff during an emergency. From information gathered following an attack and plotted on the master map, the activities of each service will be directed through the service headquarters established in the control center.

Detroit is well pleased with the progress to date on the control center, and is ready for operational exercises to develop and perfect control

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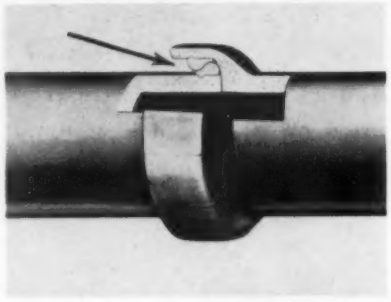
Published Monthly **April, 1955**

Self-Sealing Joint Developed for Vitrified Clay Pipe

Development of Wedge-Lock clay pipe, a new root-proof, infiltration-proof vitrified clay pipe with a self-sealing, double-ball mechanical joint, has been announced by member manufacturers of Clay Sewer Pipe Association of Columbus, Ohio. The new product will be available within the next six months. Wedge-Lock for vitrified clay pipe (patents are pending), is designed for installation wherever root-proof joints are desired. The new pipe is available in 4, 6 and 8-inch diameters, both standard and extra-strength, through CSPA members. A complete line of matched fittings and a special union for jointing cut ends also are provided.

Wedge-Lock has a wide, solid ring of plastisol around the spigot end of the pipe's barrel. A conical ring of the same plastisol is cast inside the bell. Following a light application of water, clay and water mixture, oil, or adhesive, the spigot is inserted into the bell of the adjoining length. The length is then "shoved home" forming a water-tight, root-proof joint in seconds. The plastisol casting in the bell aligns the pipe and holds it securely. Use of an adhesive compound is recommended where hydrostatic tests are required.

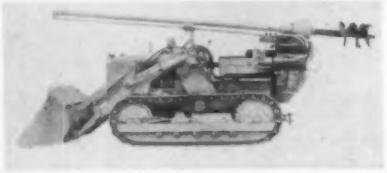


Wedge-Lock joint for vitrified clay pipe is root and infiltration-proof

When the adhesive sets, the two plastisol castings fuse permanently, allowing neither sewage to seep out nor ground water to seep into the line. Even the finest plant roots cannot penetrate the line. The flexibility of the joint enables it to withstand heavy vibrations and abnormal earth movement. The new pipe also shows remarkable labor-saving advantages. It is possible for one man to lay a 50-foot line in less than 10 minutes. For more data, circle No. **4-1** on the coupon.

Earth Drill for 50 H.P. Allis-Chalmers Tractor

An earth drill has been added to the Allis-Chalmers line of matched attachments for its 50-hp. HD-5 crawler tractor. This heavy-duty drill is mounted without disturbing either front-end shovel or dozer already on the tractor. The drill, the Model YT, is driven through a tractor power take-off. Adjustment for drilling positions is hydraulically controlled. With the series of flights available, the new drill can bore holes up to 24 inches in diameter. Optional equipment includes a pole setter capable of handling poles up to 45 feet in length.



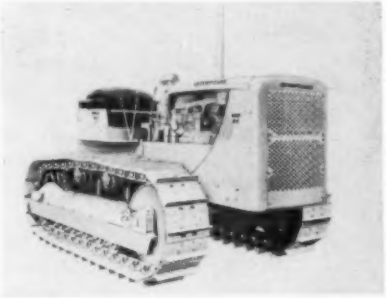
Earth drill designed for HD-5 tractor bores holes to 24-inch diameter

The new tractor-mounted drill is a highly mobile unit permitting pioneer drilling work off-the-road. Jobs performed include fence post and pole drilling, exploration for foundations and soil sampling. In addition, the drill-equipped HD-5 also serves as a dozer or loader on the job depending on whether equipped with shovel or blade. Full data from Allis-Chalmers Mfg. Co., Tractor Division, Milwaukee 1, Wisc., or circle No. **4-2** on the coupon.

NEW CATERPILLAR D7 FEATURES MANY IMPROVEMENTS

Increased horsepower and engine speed highlight many new engineering improvements which have been introduced in the new D7 track-type tractor, announced by Caterpillar Tractor Co. The engine has 128 horsepower at 1,200 rpm; the maximum draw-bar pull is 28,700 pounds. Other major engineering features which contribute to greater productive capacity in the new D7 include: redesigned engine block; new fuel injection system; a new starting engine; new radiator; larger fuel tank; new fuel filter system; redesigned oil filter base adapter; and improved air cleaner.

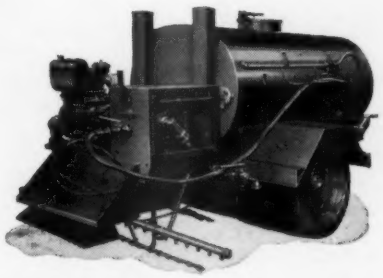
Quicker starts are obtainable with the more powerful starting engine now standard on this tractor. This starting engine has a single lever control for greater ease of operation. A radiator which provides full width water cores is being introduced on the D7. The additional water core allows a reduction in fan horsepower. Capacity of the fuel tank is 85 gallons, a 15-gallon increase over the predecessor model. New and efficient impregnated paper filter elements are used in the redesigned fuel filter compartment. More from Caterpillar Tractor Co., Peoria, Ill., or circle No. **4-3** on the coupon.



New Caterpillar D7 track-type tractor features increased horsepower

Bituminous Distributor for Maintenance and Construction Jobs

A newly designed S-J maintenance distributor has been announced by the Standard Steel Works. Designed specifically for jobs where larger equipment is expensive to operate, this new distributor can be diverted instantly from such jobs as patching and shoulder repair to major secondary road construction. All operations are confined to the rear of the unit, eliminating unnecessary trips from front to back. It is built for truck mounting or as a complete unit in itself. The full width rear platform gives the operator a clear view of the entire length of the spray bar and permits more working area than previously. All piping and valves are flanged to permit easy repair or replacement. It is not necessary to remove the entire piping to replace small sections. Standard burners have chambers, which when carboned, can be easily cleaned on the spot. More from Standard Steel Works, North Kansas City, Mo. or circle No. **4-4** on the coupon.



Standard Steel S-J maintenance distributor offers operating economies

• • •

Multi-Use Diaphragm Pump

For seepage handling; septic tank cleaning; mud handling; catch basin, trap and pit cleaning; and moving high-solid-content water, Barnes has announced a 3-in. diaphragm pump. It weighs only 235 pounds, and is easily handled by two men. It has a handle for portability and a lifting bail for mechanical loading. Suction and discharge are 3-in.; capacity is 3600 gallons per hour at 10 ft. head; maximum suction lift and discharge head are 25 feet. More from Barnes Mfg. Co., Mansfield, O., or circle No. **4-5** on the coupon.

Single-Pass Portable Crushing Plant Has Diesel-Electric Drive

This newly-designed Austin-Western, single-pass, diesel-electric portable crushing plant can produce two sizes of material and has good application on jobs where high portability and ease of operation are required. All components, except the crusher, are driven by individual electric motors, instantly controlled by push button from the operator's platform. Economy in operation and maintenance is obtained because of the elimination of chains, idlers, sprockets and clutches. The plant, which can also be furnished with straight mechanical drive, weighs approximately 20,000 lbs. Components are a loading hopper with grizzly, mechanical feeder, a 2x6 double-deck, inclined gyrating screen, 1024 roller bearing jaw crusher, 24-inch by 27-foot delivery conveyor and an 18-inch by 20-foot sand reject conveyor. The plant requires a 45 hp gasoline or diesel engine. More from Baldwin-Lima-Hamilton Corp., Construction Equipment Div., Lima, Ohio, or circle No. **4-6** on the coupon.

Densludge System Reduces Digester Capacity Needs

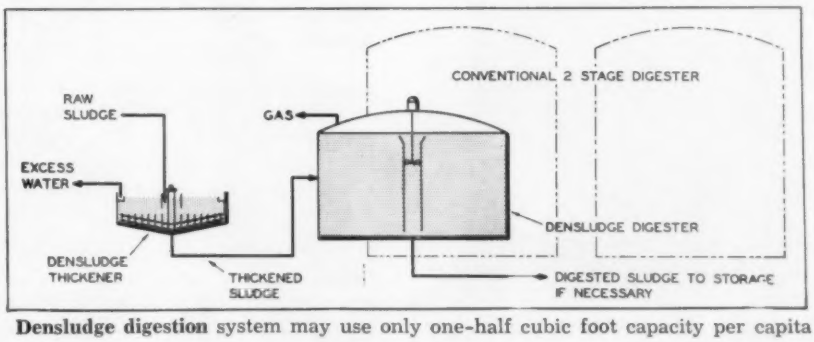
Dorr - Oliver Incorporated announces the development of Dorrco Densludge Digestion for the digestion of sewage sludge. When it is employed in combination with the Dorrco Densludge Process of sludge thickening, digester capacity requirements are decreased 67 to 78 percent depending upon the type and degree of treatment. Capacity reductions are due to physical means which increase efficiency by mixing during digestion and by thickening before digestion.

When this process of sludge thickening is employed with Densludge digestion, raw sludge is concentrated in a thickener before being digested; excess water is removed before, rather than during, digestion; and supernatant and the need for secondary digestion is eliminated. With but half the volume of sludge to be digested only half the capacity is needed in the primary digester. Another saving in volume is realized by using a draft tube mixer to increase volume utilization from 35 to 65 percent.

In the digestion of a mixture of primary and modified aeration sludges, sludge thickener underflow has averaged 10 percent solids going to the digester and solids loading has been 9 lbs. of solids per cubic foot per month. Under these conditions, digestion has been carried out using only 0.5 cubic feet of capacity per capita—25 percent of conventional design. Similar reductions in digester capacity have been accomplished with secondary treatment by Biofiltration. Here sludge concentration has averaged 9 percent with a loading of about 8 lbs. of solids per cubic foot per month. Per capita capacity requirements averaged 2/3 cubic foot, or 22 percent of conventional design.

Dorr-Oliver states that corresponding savings are also possible when digesting other types of sludges. Only 23 to 33 percent of conventional design capacity is needed to digest activated, primary or low-rate trickling filter sludges.

The major advantage is the reduction in digester capacity requirements and digester size. Elimination of supernatant reduces raw sludge heating requirements. In addition, digester action becomes more stable as thickening removes excess water which dilutes and washes out alkalinity. Further information is available from Dorr-Oliver Incorporated, Barry Place, Stamford, Conn. or circle No. **4-7.**

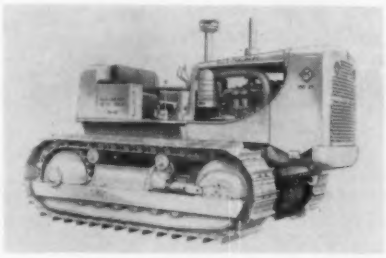


Densludge digestion system may use only one-half cubic foot capacity per capita

Big 204 H.P. Tractor Introduced by Allis-Chalmers

The new Allis-Chalmers HD-21 tractor weighs 44,000 lbs., develops 204 hp. at the flywheel and has torque converter drive as standard equipment. Among its many new design features are a new high-capacity cooling system, a new master clutch, new transmission, new Tru-Dimension track, new Wrap-Around radiator guard and the new Allis-Chalmers diesel engine. One of the most significant developments is the performance of the torque converter-engine-transmission team. This combination provides extra speed with any load, extra pulling power at any speed, plus wider speed ranges and more range overlap.

HD-21 features include a new "Wrap-Around" radiator guard which reduces the cost of tractor-bulldozer combinations by permitting the hydraulic rams or cable-lift sheaves to mount directly on the new guard. For easy service accessibility, the guard tilts forward and down. A new all-weather cooling system is used, including a large, one-piece radiator which handles coolant water only and has an independent mounting to provide protection from external damage. A separate heat exchanger insures cooling of torque converter fluid, and an engine lubricating oil temperature regulator insures proper operating temperature in cold or warm weather. Operator benefits include foam-rubber-cushion seats and arm rests; hydraulic steering; a wide, clean platform and clear, unobstructed visibility. For more complete information, write Allis-Chalmers Mfg. Co., Milwaukee 1, Wisc. or circle No. **4-8** on the coupon.



Giant new crawler tractor, the HD-21, now in production by Allis-Chalmers

New Power Sweeper for Municipal Work

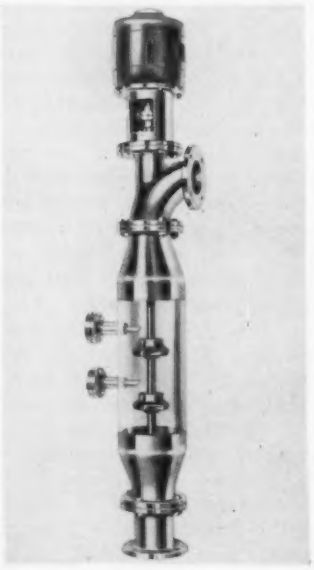
The Wayne Manufacturing Co. has started production on a new 4-model line of power sweepers for municipal use. All feature Wayne's original "Filter-Vac" dust control with easily removable dust bin, automatic dumping, large hopper capacity, 20-inch curb brooms for closer sweeping and good maneuverability. Individual performance figures show the new Wayne power models meet the sweeping problems of park, sanitation and public works departments with efficiency and economy, having a range of sweeping paths from 24 to 58 inches and a maximum sweeping coverage of over 100,000 square feet per hour.

Compact, maneuverable Wayne **sweeper**

National sales and service of the new Wayne Power Sweeper line will be handled by existing Wayne dealers. New dealer appointments are being made. More from Wayne Mfg. Co., Pomona, Calif. or circle No. **4-9** on the coupon.

Continuous Pipeline Chemical Mixer

The "American" Homomix continuous pipeline mixer is now available in sizes and capacities from 1 gpm to 10,000 gpm. This mixer mixes instantaneously at the point of entry, provides violent, uniform and complete blending on one or more chemicals (liquid, gas or slurry) continuously or intermittently, without the use of a mixing tank. It is easily installed in vertical, horizontal or inclined position, in any pipe line. It is specially adapted for use where space and head are at a premium. Further information from American Well Works, Aurora, Ill., or circle No. **4-10** on the coupon.



Phantom view of American Wall Works Homomix, at right, shows chemicals are introduced near diffusing rotor

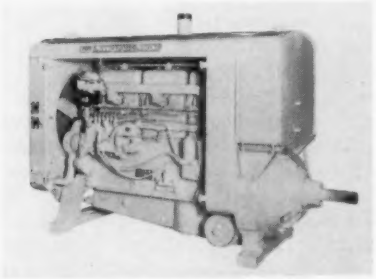
GE Two-Way Radio Equipment

The General Electric Company has announced a complete new line of FM mobile and base station two-way radio communication equipment for both 25-54 megacycle and 144-174 megacycle land-mobile radio services. Featuring the use of plug-in chasses, the line was designed around twelve basic "building blocks" of standardized physical dimensions. Flexibility has been provided by designing each of the chasses (transmitters, receivers and power supplies) so that it is completely interchangeable with other units of its type mounted in either a base station or mobile housing. The twelve basic building blocks consist of two receiver, four transmitter and six power supply chasses. Sixty different mobile two-way radios are available as standard units by combining the appropriate "blocks."

All receivers, high or low band, mobile or base station, are physically interchangeable because they are plug-in units. All will operate from either a six or twelve-volt DC source or from a 117-volt AC power supply without modification of any kind. All receivers are available for either wide band or narrow band operation. Conversion of band width to either wide or narrow band operation can be performed in the field by adjusting the IF amplifier coil coupling, identified by "N" for narrow band and "W" for wide band. Full data from General Electric Co., Electronics Park, Syracuse, N. Y., or by circling No. **4-11** on the coupon.

Diesel Industrial Power Unit Provides 95 Horsepower

A new industrial power unit, the D605-6A is announced by Minneapolis-Moline. This is a diesel unit, using No. 1 diesel fuel, and produces 95 hp. The six cylinders are of alloy iron, cast in pairs. The injection pump for the fuel system is of the multiple plunger American Bosch type. The power take-off is



Diesel power unit offered by Minneapolis-Moline delivers 95 horsepower

by 14-in. Twin-Disc clutch. Optional safety equipment includes engine cut-offs when oil pressure fails or when water temperature is excessive. Full information from Minneapolis 1, Minn., or circle No. **4-12.**

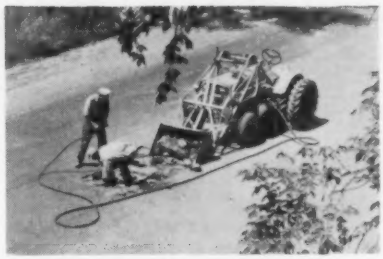
Micro-Straining for Water Filtration

Micro-straining is a patented method of membrane filtration, employing finely woven stainless steel fabrics as filtering media, having apertures which can be as small as 23 microns, with as many as 165,000 apertures per square inch of the fabric. The system employs rotating drum filters covered on their periphery by the straining fabric. The water passes inwards through one end of the drum and outwards through the fabric, forming on the filter fabric a mat of solids. This mat is continuously washed back into a hopper. Rotation of the drum at brisk speeds and the cleansing of the fabric thus proceeds uninterrupted. Flow is under open gravity conditions.

The employment of Micro-straining is said to be justified where operating conditions are suitable, by the very much lower capital charge, the small operating costs, the low head loss (inches only), the extreme compactness of the installations, and the short construction periods involved, coupled with completely automatic and continuous operation. Information on this English device can be obtained from Glenfield & Kennedy, Inc., 677 Fifth Ave., New York 22, N. Y. or circle No. **4-13** on the coupon.

"Tractair" Power Increased; Attachments Listed

The air output of the Le Roi Tractair has been increased from 105 to 125 cfm. This unit is a combined 125 cfm air compressor and a 35 hp wheeled tractor, designed for hard-to-get-at places. An Econotrol varies the engine speed to match air demand. The Tractair has five traveling speeds, with a maximum speed of 17 mph. The high ground clearance combined with the low center of gravity allows it to operate on a two-to-one slope. The following attachments can be applied to a variety of jobs: Mobildrill, highway patch drill, multiple tamper, winch, backhoe, front end loader,



Versatile "Tractair" provides compressed air; mounts front end loader

backfill blade, utility boom, utility platform, rotary sweeper, snow plow. More from Le Roi Division, Milwaukee 14, Wis., or circle No. **4-14.**

Backhoe Digs Deeper, Loads Higher

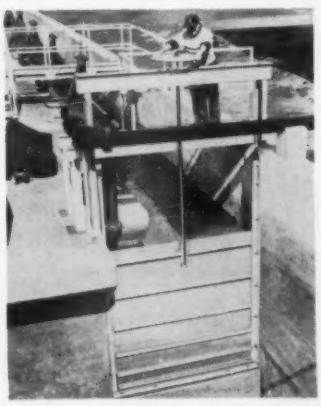
The new Henry hydraulic backhoe has a telescopic boom that is hydraulically operated and fully automatic, extending and retracting as the operation requires. It digs 10 ft. 6 in. and loads 8 ft.—a digging and lifting cycle of 18 ft. 6 in. A standard boom digging 8 ft. is also available. The backhoe digs from one position at any angle inside its 160 degree swing radius. It is particularly well adapted to digging close to buildings and hard-to-get-at places. Henry backhoes are easily attached to or detached from almost any standard make or model of wheel or track-type tractor. They are used by contractors, builders, city and highway commissions, industries, institutions and public works for digging trenches, pits, laterals, footings, foundations, water mains, and septic tanks. Complete information from Henry Mfg. Co., Inc., 1700 N. Clay St., Topeka, Kansas, or circle No. **4-15** on the coupon.

Aluminum Floor Gratings and Stair Treads

Floor gratings and stair treads of aluminum are now being made by Kerrigan Iron Works. The non-sparking quality of aluminum grating makes it ideal for use in confined areas to reduce fire hazards. It is light weight, non-magnetic, non-corrosive, has no maintenance costs and its high strength insures many years of trouble-free service; its open construction allows for the passage of light and maximum air circulation. Complete data from Kerrigan Iron Works, Inc., Nashville, Tenn., or circle No. **4-16** on the coupon.

Advantages of Aluminum Slide Gates

A low cost, easily installed aluminum slide gate has been announced by Rodney Hunt Machine Co. The gate, made of sheet aluminum reinforced with extruded aluminum angles, can be used where economy as well as function can be served, for example, as a stop-gate in by-pass channels. The gate is low in cost and only a simple frame is required for installation. It is controlled by a manually operated bench-stand hoist with control stem. It is corrosion resistant. The manufacturer recommends use of the aluminum slide gate when odd channel sizes are present in design, full channel flow is desirable, and where closure can be made under balanced conditions. For more information write Rodney Hunt Machine Co., Orange, Mass., or circle No. **4-17** on the coupon.



Low cost aluminum slide gate is easily operated manually

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Gasoline Engine Driven Electric Eel for Sewer Cleaning

Designed to clean sewers, waste and process lines from 4 ins. to 16 ins. in dia., where electricity is not available, this new Electric Eel will clean out roots, stones and debris in one operation. It will clean lines up to 500 ft. in length, operated by one man. This unit has a 2-hp gasoline engine, with a built-in clutch and a transmission which provides two forward speeds (500 and 200 rpm). The dual cable used is self-feeding and eliminates helixing and loss of cable in the line. For manhole work, such appliances as guide tubes, guide tube jacks, swivels, etc. are available. An electric drive unit can be substituted for the gas drive. Further details from Ohio Tool and Engineering Co., 515 N. Spring St., Springfield, O., or circle No. **4-18** on the coupon .

Porous Stainless Steel Filters for Swimming Pools

These new Micro Metallic filters are designed to operate at standard pool system pressures (35-50 lbs./-sq. in), but can handle double these pressures if needed. Used in pool water-recirculating systems, the Micro filter removes even microscopic particles and is readily cleaned by backwashing. To make the filter element still stronger and more easily installed, the porous metal tube and its mounting fittings are welded into a single unit. Filter tube replacements or complete "package" filters are available from the manufacturer. More from Micro Metallic Corp., A Pall Filtration Co., 30 Sea Cliff Ave., Glen Cove, N. Y., or circle No. **4-19** on the coupon.

New Pump Design for Handling Raw Sewage and Sludge

Said to be completely non-clogging, this new type of pump is intended for completely trouble-free handling of sewage, sewage sludge, pulp of very high solids content and liquids containing coarse, abrasive, soft or fibrous materials. The impeller is located out of the main flow path so that materials do not have to pass through it. Pumping is accomplished by the creation of a vortex action, developing the suction and pressure heads necessary for efficient pumping. Pumps are available in sizes from 2-inch to 10-inch, with capacities up to 4,000 gpm, with heads up to 70 ft. Full information from Western Machinery Co., 760 Folsom St., San Francisco 7, Calif., or circle No. **4-20** on the coupon.

Front-End Loader for International Tractors

The new Wagner heavy duty model WMD-6 loader operates off the International I-300 tractor's hydraulic system and utilizes a half-yard bucket as standard. To handle loads of this size, the new model is equipped with twin, self-equalizing attachment cylinders. Down pressure side cylinders afford extra bucket and blade penetration. Like other models in the Wagner line,

Wagner heavy-duty loader has half-yard bucket as standard

the WMD-6 offers the easy access of step-in design. More from Wagner Iron Works, Milwaukee, Wisc., or circle No. **4-21** on the coupon.

Motor Grader for Very Heavy Duty Grading Work

This grader, the 5D-190, is the first new Huber-Warco Co. product and is the first motor grader with 190 hp. The power is supplied by a General Motors 6-71 diesel engine, through a torque converter and full power shift transmission. The tail shaft governor automatically adjusts the engine rpm to meet any load conditions, at any ground speed set up by the operator. Ground speed ranges from 0.85 to 20 mph. The weight of the machine is 32,000 lbs.; size of tires is 16.00 x 24. All wheels are interchangeable, providing longer tire life. Completely cab-controlled blade movement makes it possible for the operator to shift the blade from 90° on one side to 90° on the other in less than a minute. This operation is performed hydraulically. A high-arched front axle gives a front-end clearance of 32-ins., permitting the grader to straddle high windrows and providing greater clearance for rough cuts. Other features include: mechanical steering with hydraulic booster; high blade clearance; and retractable scarifier, permitting 360° blade rotation without removing scarifier teeth. Further details from Huber-Warco Co., Marion, Ohio, or circle No. **4-22.**

Vinyl Mastic Protective Coating to Prevent Corrosion

A vinyl mastic protective coating that need be applied in only one coat, called Amercoat No. 87, can be applied at a thickness of 10 mils in one double-pass spray coat. Despite its unusually high solids content, it can be applied with conventional industrial spray equipment. The dense, highly impermeable protective film does not flow away from edges and sharp corners, therefore providing extra protection for areas which are particularly susceptible to corrosive attack. Other advantages are that it has a non-volatile content in excess of 55 percent. Complete data from Amercoat Corp., 4809 Firestone Blvd., South Gate, Calif., or circle No. **4-23.**

Complete Line of Portable Electric Plants

The Gen-A-Matic line of portable electric plants includes 22 models, ranging from 275 and 500 watts, 6 and 12 volts to 4,000 watt, 120 volt models. Both AC and DC models are manufactured, with operating speeds ranging from 2800 to 3600 rpm. In addition to this line, the company also has an electric plant designed to supply portable or standby power for every use as the source of power where central station service is not available; as protection against power failure; for operation of power tools on remote locations; and auxiliary lighting. More from Multi-Matic Corp., 14741 Bessemer St., Van Nuys, Calif., or circle No. **4-24** on the coupon.

Loaders for Small Tractors; A Broom Adaptation

Shawnee has announced a new heavy-duty loader for use with the John Deere and other small crawler tractors; a special loader adapted to the Allis-Chalmers WD 45; and a street broom for the Shawnee special loader. The heavy-duty loader handles a ⅝-yd. bucket—a ton of material—and dumps at 9 ft. The

Shawnee loader designed for light tractors. Other attachments are available

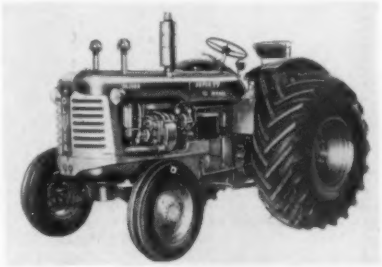
special loader handles buckets up to ⅝-yd. and also dumps at 9 ft. The broom is an additional attachment —bulldozer and angledozer blades are already available. This broom is 7 ft. wide and hydraulically driven; it can be angled to 30° either way, and revolved at 150 to 350 rpm. Special mounting provides excellent operator vision. More from Shawnee Mfg. Co., 1947 North Topeka, Topeka, Kans., or circle No. **4-25** on the coupon.

Light Roller Does Small Compaction Jobs

This is a 1½-ton roller which is designed for light job compaction, including driveways, playgrounds, parking lots, sidewalks and patches. It can work within ¾ inch of a wall or post. The main roll is 36 ins. wide and 30½ ins. in diameter. Engine is 6-hp. air-cooled. It comes with a 60-gal. sprinkler tank; and a low trailer for quick and easy transportation is available. Ask for data on the Ken Roll from Pfahler Mfg. Co., Route 3, Galion, O., or circle No. **4-26** on the coupon.

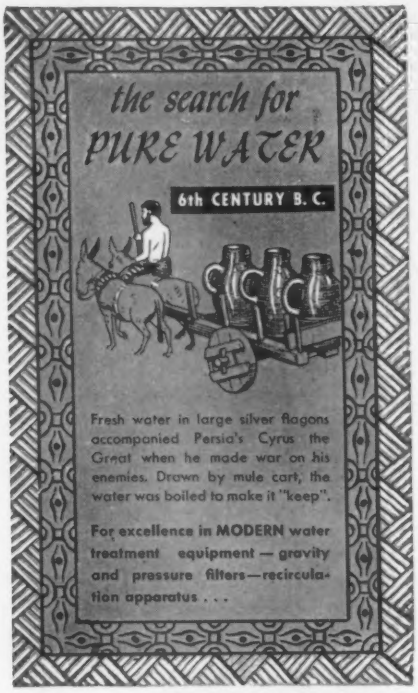
Super Diesel Wheel Tractor Added by Oliver

The Oliver Super 99 GM Diesel tractor is now in production by the Oliver Corporation. According to



Oliver wheel tractor powered by GM Diesel engine develops 72 drawbar hp

corrected ratings observed during tests, it develops 72 hp on the drawbar and 80 hp on the belt. The 2-cycle diesel engine starts quickly on diesel fuel alone; no auxiliary engine or special fuel is needed. Other advantages include a six-forward-speed transmission, a flat operator's platform with an abundance of room, rubber spring seat, double-disc differential brakes, and a recirculating ball-type steering gear that makes the tractor easy to handle. Special units include an independently controlled power take-off and a three-way hydraulic system. Further details from the Oliver Corp., 400 W. Madison St., Chicago 6, Ill., or circle No. **4-27** on the coupon.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Another example of what cities must spend in keeping clean. Indianapolis has just put in operation this fleet of 15 new White Model 3020 city refuse-type collection trucks shown above. These are 16-yard bodies, permitting faster garbage collections, fewer trips to dumps.

—Worth Seeing

J. E. (Red) McCracken (above) has just been appointed chairman ARBA executive committee on materials and supplies. To most folks in the highway field he is known as "Mr. Bethlehem Steel" Horse is "Coaly."

Pretty Janet Bailey, Akron, Ohio's, Sesquicentennial Queen, National Cherry Blossom Queen, takes time out to crown a "King." The king is a length of king-size clay pipe manufactured by the Logan Clay Products Company of Logan Ohio. Lengths up to five feet. So is Janet's.

Some times you don't need sewer pipe. Here in Miami, Fla., a coral rock formation eliminates pipe. The walls of a 2′ x 8′ trench in it plus an 8-inch slab of concrete poured over the top complete the tunnel. A Barber-Greene #44 trencher powered by a General Motors diesel does it. Wright Construction Co., contractor.

This is not a Civil Defense disaster clean-up but the wrecking of twenty houses in two-block area of Richmond, Va., to make way for World War II memorial, E. G. Bowles Co. is using an International-Drott TD-9 skid shovel on the job. Memorial is at Lee Bridge, just off US 60.

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WORTH TELLING

by Arthur K. Akers

★ DORR-OLIVER Inc. centralizes their divisional sales headquarters in Stamford, Conn., Chicago, and Oakland, Calif.

★ ARMCO Drainage and Metal Products, Dixie Division, names L. L. (Lou) Williams sales manager in Atlanta. George C. Copeland succeeds Williams as Florida state sales manager.

★THE HEIL COMPANY, Milwaukee, announces six new vice-presidents, including our old friend W. E. (Bill) Curran, assistant to the president for the past three years.

★ MARK L. STUPPY is now vice-president as well as sales manager of F. B. Leopold Inc., Pittsburgh makers of water and sewage treatment equipment.

★ A COUPLE OF beardless youths (by B-I-F's sturdy New England standards) are pictured here in token of completing their first 25 years of consecutive service. "Lindy" Harper is president of Omega Machine Co., John Hartley is vice president and manager of project sales, Builders-Providence Inc.

Mr. Hartley

Mr. Harper

★ TONCAN CULVERT MANUFACTURERS ASSOCIATION elects Lynn J. Busby, Madison, Wis.; Rex E. Rhine, Decatur, Ga.; and G. Franklin Beall, Portland, Oregon, as trustees. Col. Hubert E. Snyder remains managing director.

★ At GENERAL ELECTRIC'S Lynn, Mass., works, Henry J. Chanon has been appointed marketing director of the Outdoor Lighting department.

★ THOMAS W. FAUNTLEROY is new assistant general sales manager of Pittsburgh-Des Moines Steel Co., Pittsburgh.

★ BADGER METER MFG. CO., Milwaukee, opens a new $600,000 foundry at Fall River, Wis. to turn out some 400,000 lbs. of brass liquid meter castings monthly. Ross J. Burns is promoted to water meter sales manager.

Mr. Burns

Mr. Clausen

★ WILLIAM CLAUSEN, executive vice-president of Enterprise Engine and Machinery Co., announces the largest diesel engine ever to be built is in production at their San Francisco plant: 16 cylinders, 6,150 hp.

★ STEPHEN D. MOXLEY is the new president of American Cast Iron Pipe Co. in Birmingham, Ala., succeeding C. Otto Hodges, retired. Arnold J. Herrmann continues as vice-president and sales manager.

★ R. P. ADAMS CO., Buffalo, appointments: Ross Engineering Co., as Chicago representatives; A. N. Dunn in northern Indiana territory. Products are filtration and swimming pool equipment.

★ HIGHWAY EQUIPMENT CO., Cedar Rapids, names Roy Gaddis, Jr., assistant general manager.

★ GAR WOOD INDUSTRIES officially denies their purchase by General Motors.

★ EMPLOYEE: "I ought to have a raise, boss. I'm doing the work of three men." Cold-eyed Boss: "Name the other two and I'll fire them."
—*Dickey Data.*

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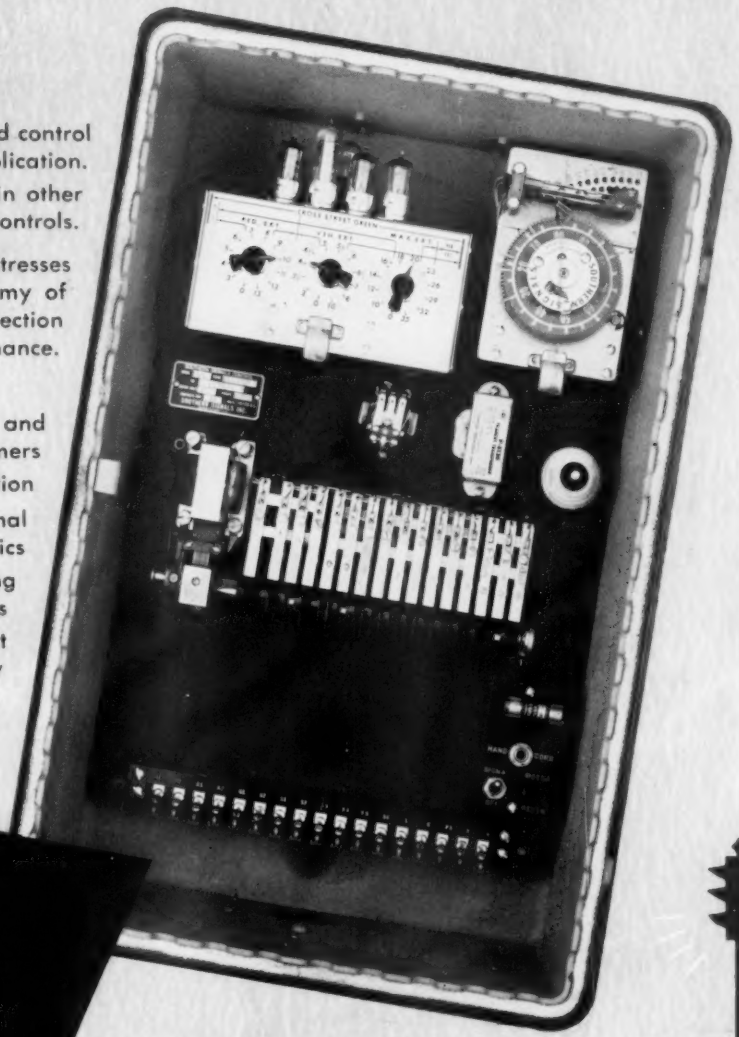

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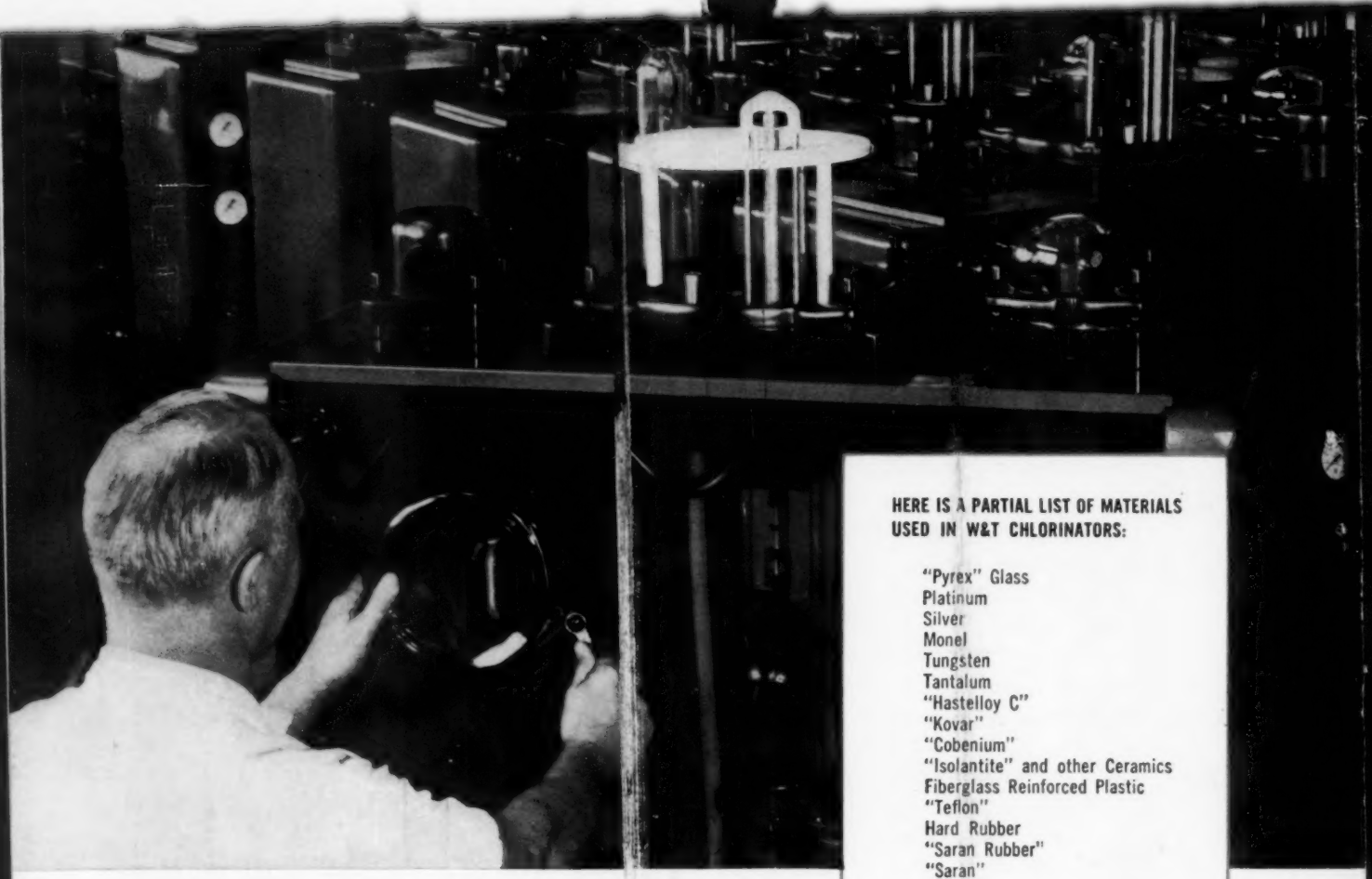

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